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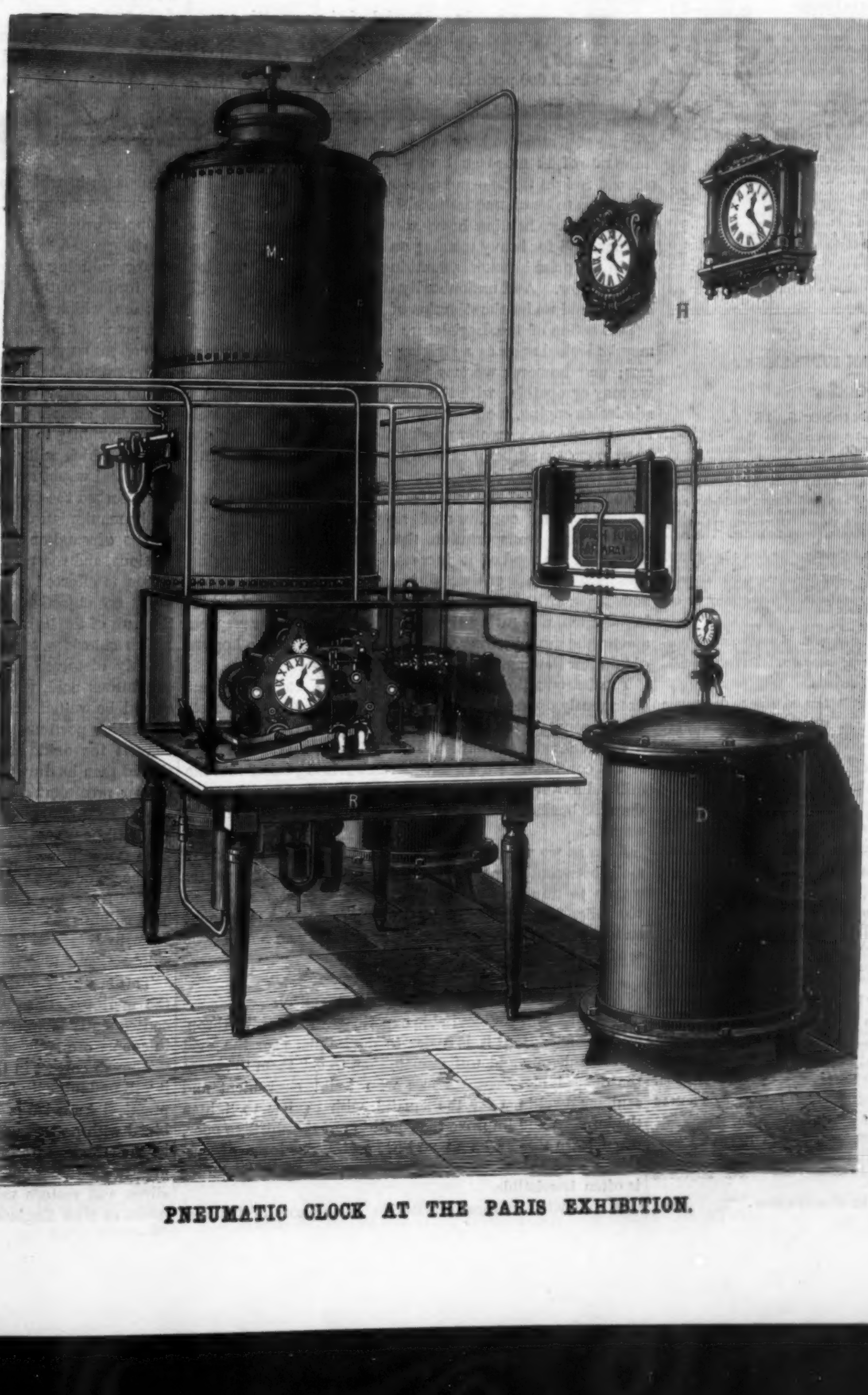
THE PNEUMATIC CLOCK.

Among the many wonderful pieces of mechanism to be seen at the Paris Exhibition, the pneumatic clocks exhibited in the Austrian section are not the least interesting. These clocks give exact time to all the clocks of a city simultaneously, whether the distance of the latter from them be six miles or sixty. The system has now been in operation for about two years in Vienna, where the time is sent in this way from the Imperial Observatory, through tubes laid along the gas mains in different parts of the city, to all the public clocks, the hands of which all move by this arrangement at the same time. The city of Paris has recently authorized the "Société des Horloges" to make a public trial of this pneumatic apparatus, with a view to the possible adoption of the system.

The principle upon which these clocks work is this: "If a column of air, inclosed in a tube at a given tension, be subjected to pressure, it immediately transmits that pressure to all its parts, even the most remote." But the compressed air, after having exerted its force, must be expelled from the tube and replaced by a fresh column; because, if the tube were not alternately opened and closed, this column would act precisely like an elastic spring; consequently the mechanical effect on the pistons would be insignificant, and the hands of the clock would remain at a standstill, powerless to move. The pneumatic clocks are at once simple and perfect; they are not likely to get out of order, and the escape of air, even, from the distributing pipes cannot alter their movement. This mechanism is extremely simple, and may be described as follows: Air is injected into a metallic cylindrical reservoir, M, by means of a hydraulic motor; from thence this air is led into another large cylinder or distributer, D; it is only used, however, as fast and in such quantities as needed by the regulator. At every minute the air from the regulator enters the lead or iron distributing pipes, and acts on a leather piston inclosed in a small cylinder attached to a lever; and the latter determines the movement of an escapement that moves the hands of the receiving dial, H. This lever receives the pressure communicated by the central motor, R, and at every movement causes an escapement wheel to advance one notch, marking one minute of time. At every unlocking of the escapement wheel, the air from the distributer ceases communication with the distributing pipes, and escapes into the atmosphere. The regulator of the central motor, R, is an endless chain clock as perfect as possible, furnished with a compensating pendulum. This receives astronomical time from the public observatory, and transmits it to the dials, distributed in different quarters of the city, as well as to those of private dwellings. In order to prevent any accident, and as a simple measure of precaution, each central station is provided with twin motors, each complete in all its parts, and only one of which is in operation at a time. These two motors are connected automatically, in such a way that if, through an accident, the working machine suddenly stops, the other one at once begins operation, thus preventing the least retardation in the movement of the clocks. These clocks are so constructed that they must work perfectly or not at all; there is no alternative. The invention is due to Mayrhope, an Austrian engineer; but the merit of perfecting it belongs to M. Victor Popp, who during the last two years has attentively watched the working of these clocks at Vienna, correcting and modifying the apparatus day by day, until at length he has been able to present a system which is complete and perfect at every standpoint from which it may be regarded. As well known, the experiments made with the electric system have proved impracticable. Electric clocks are among the most unreliable of chronometers, electricity, by its very nature being the most capricious of physical agents, and the intensity of the current varying with the nature, species, and charge of the battery, and with the resistance of the conductors, media, exterior temperature, etc. However, by means of ingenious, complicated (and consequently very costly) mechanisms, certain very accurate electric clocks have been constructed, but their high price places them beyond the reach of any but the wealthiest institutions, and they are consequently unable to respond to a public demand. The invention of pneumatic clocks, then, appears to be of such real utility, and supplies such a pressing necessity, that we may expect to see them gradually adopted by all large cities.



PNEUMATIC CLOCK AT THE PARIS EXHIBITION.

Depth to which Roots Penetrate.

Mr. Foote, in Massachusetts, has traced the tap root of a common red clover plant downward to the perpendicular depth of nearly 5 feet. The Hon. J. Stanton Gould followed out the roots of Indian corn to the depth of 7 feet, and states that onions sometimes extend their roots downward to the depth of 3 feet; lucerne, 15 feet. Hon. Geo. Geddes sent to the Museum of the New York State Society a clover plant that had a root 4 feet 2 inches in length. Louis Walkhoff traced the roots of a beet plant downward 4 feet, where they entered a drain pipe. Professor Schubart found the roots of rye, beans, and garden peas to extend about 4 feet downward; of winter wheat, 7 feet in a light subsoil, and 47 days after planting.

Transferred Engravings.

If dirty, the print may be cleaned by means of bread crumb; then, to soften the ink, the print is put to soak in a 3 per cent solution of strontic oxide, kept at a temperature of about 83° C.; the necessary time for soaking can be found by experimenting on a piece of margin or extraneous matter, cutting off a small piece, drying it, then damping with nitric acid as hereafter described, and then observing whether it gives a set off on being rubbed against another piece of paper with the thumb nail. The length of time may vary from ten minutes to an hour and a half. When the print is removed from the solution it is thoroughly and carefully washed with hot water, superfluous moisture being absorbed by blotting paper; it is then laid face downward on a few layers of blotting paper, and the back well brushed with a 20 per cent solution of nitric acid until the paper is evenly and thoroughly soaked; it is then dried between successive sheets of blotting paper. The zinc plate is prepared much the same way as for zincography, with the exception of graining; instead of this it is rubbed with Water of Ayr stone, and finally polished with pumice powder. In transferring, much stronger pressure is required than for zincography; indeed, theoretically, a copperplate printing press should be used, but in practice a good litho press will be found to answer almost as well. After having adjusted the pressure, place the print face downward on the plate, and immediately pull it firmly and evenly through the press. An intervention of 30 seconds after the print is put on the plate would be fatal to success.

After the print is peeled off the plate is sponged over with unsoured gum water; water is then sprinkled on, and it is gently washed with a clean rag to remove any adherent particles of paper; the transfer on the plate is then rubbed over with a mixture of lithographic ink, thin varnish, and gum water, by means of a fine sponge, care being taken to have an excess of gum water to prevent "blacking up." When sufficient ink has adhered to the lines the plate is flushed with water under the tap, and is then slightly etched with phosphoric acid and gum water solution, diluted with its bulk of water; the plate is next rolled up with printing ink and re-etched with the normal solution. It is now ready for use, and can either be printed from in a litho press, or it can be etched by acid, and then printed typographically.

In preparing freshly printed matter the print is at once saturated with the nitric acid solution, all further manipulation being the same, with the exception, perhaps, of rather less pressure in transferring.

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 144,

For the Week ending October 5, 1878.

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STEAM ON THE COMMON ROADS.

A prediction made about ten years since by an eminent civil engineer, that the time was not far distant when the business of railroads would be confined to the transportation of passengers, mails, and costly freight, and that all produce and other heavy or bulky merchandise would be transported by means of steam road wagons over the common roads, or over roads graded especially for the purpose, does not, by the lights of the present times, appear so visionary as it did then. Indeed, it seems quite possible that before another quarter of a century has passed the prediction will be verified so far, at least, as concerns all roads running through the thickly settled parts of the country and to all the feeders of the great trunk lines.

Just previous to the designing of the Union Pacific road the establishment of quicker connection with the Pacific coast by means of steam road wagons, as they are called, was very seriously contemplated, and in fact considerable expense was incurred by the promoters of the project in examination and surveys of the proposed routes, and in constructing an efficient motor.

The plans were carefully investigated and received with favor by competent engineers and men of capital, and would doubtless have been carried into effect in a short time; but at this crisis the necessities of the country demanded the immediate connection of the Atlantic and Pacific seaboards, and the friends of the new and untried project wisely shrank from a hopeless struggle against its well-approved rival.

Of the special motor which was to have been the pioneer in this method of trans-continental transit, and which was then thought to be admirably adapted to the purpose, we have since heard nothing; but inventors and believers in the principle have not in the meanwhile been altogether idle, and both here and in England road locomotives or steam road wagons, of various designs, and adapted to various uses, have been in use for some years, and their numbers are constantly and rapidly increasing.

The public need of some cheap and practical substitute for horses and other animals on highways and farms, and the belief inspired by what had already been accomplished, in the possibilities of the road engine, induced the Legislature of Wisconsin, two years ago, to offer a reward of $10,000 for one which should do certain work under certain conditions.

Though the most nearly successful of the competing machines cost but $1,000, and could be run at an expense of from $2 to $6 per diem, according to the work performed, weighed but 6,600 pounds loaded with water and coal for an eight miles' run, hauled a wagon and load weighing 3,500 pounds over 201 miles of ordinary country roads at an average rate of 6 miles an hour, and over some parts of the road at the rate of 12 miles an hour—the average speed of our railroad freight trains—and although it was pronounced by the judges to be of unquestionably great advantage in plowing, thrashing, hauling heavy machinery from one farm to another, and for heavy teaming on the highway, it failed to obtain the prize because something in every way superior is looked for. And undoubtedly this something better will be produced under the stimulus of the offered reward.

This action of the Legislature in withholding the reward may be looked upon as a striking example of faith in progress; and however we may judge of it, or however much we may sympathize with the disappointed inventor of this admirable engine, we fully believe that what has been done is proof of much greater possibilities, and that we shall not have long to wait before announcing an engine that will fulfill all the required conditions.

The agricultural and manufacturing industries that are established along our lines of railroad generally demand cheaper land transportation than can ever be afforded by them, and the need of it increases each day with growing competition, while at short distances from railroad lines the added cost of hauling by animals is so severe a tax on farming and manufacturing that such locations, in other respects among the most inviting, are passed by by those who hope to obtain fair remuneration for their labors.

The introduction of this system will of course be most strenuously opposed by the most powerful invested interests of the country, anxious about the millions invested in their freight lines and dreading to lose their grasp upon the riches of the continent; but we have an unwavering belief that the railroad as a freight carrier will a few years hence have to share its business, to a great extent, with the common road wagons.

Even as we write the contractors for carrying the daily mail between Yuma and San Diego are building a steam wagon to transport passengers, baggage, and mail across 100 miles of desert which lies in their route, and they count on traveling at the rate of eight or ten miles an hour on the sandy roads.

PEOPLE WHO CAN'T BE HELPED.

It is a painful yet inevitable experience of the philanthropically minded, that it is easier to devise plans for the good of the unhappy and unfortunate than to get them to accept the offered blessings. Those who build convenient and sanitary dwellings for the squalid, with a view to lighten the burdens and improve the condition of the shiftless poor, often learn this lesson at no little cost. The force of custom is hard to overcome, and when sustained by prejudice is often irresistible.

A somewhat comical illustration of this sort of fruitless effort to do good comes from the Laccadives. On those islands the excessive multiplication of palm rats threatened the existence of the inhabitants. Living in the crowns of the cocoanut trees, the rats nibbled off the young nuts, and the fear of starvation and ruin fell upon all the people. They appealed to the Indian Government for aid. The government responded by sending over a stock of cats. But as the cats could get fish to eat below, they declined to climb ninety feet up the trees to get rats. Tree snakes were then tried, but the villagers were prejudiced against reptiles and killed them. Then the government sent out a consignment of mongooses, but the mongooses declined to climb trees after rats while they could get chickens on the ground. With cats and mongooses on the ground refusing to ascend to the rats, the officials decided that all that was required was to make the rats descend to the cats and mongooses, so they sent the islanders over some owls. But they had overlooked the popular prejudice against these birds, and in committee assembled the people decided that even rats up in the trees were better than these "devil birds." They accepted the birds in all apparent gratitude, but as soon as the coast was clear, the owls, cats, and mongooses were all conveyed in procession to a boat and solemnly deported to an uninhabited reef.

WORKING OF COPPER ORES.

A very noticeable feature of the mining matters of the West is the manner in which our miners treat, or rather neglect, the rich ores of copper which are found in the greatest abundance on every hand, estimating them of value only according to the amount of gold and silver they carry, utterly ignoring or overlooking, in their search for the more precious metals, one which, in many instances, would far better reward the expenditure of labor and capital, if but half the scientific study were devoted to the development of an economical method of working it that is bestowed upon ores of less value.

While it must be admitted that the processes now in vogue are too complicated and expensive to warrant their application to these ores under the present or immediate prospective conditions of the market for copper, it yet is a matter of surprise that no cheaper process has been found. Indeed, we know not of another instance in which the science of metallurgy has been so much at fault—has so signally failed in adapting the cost of production to the merchantable value of the metal.

It is not, perhaps, reasonable to expect that those busied in getting the gold and silver should pay any further attention to the envelope that bears them than is absolutely necessary for the purpose of getting rid of it, unless some very simple process, complementary, it may be, to that by which the precious metals are extracted, shall be designed for the purpose.

Furnaces in which ores are roasted with salt are among the most common appliances in the mining regions, and a "copper process," of which these should form a part, has been suggested to us. The plant would consist of machinery for reducing the ore to a proper fineness, a reverberatory furnace of the style above mentioned (with some simple addition, which will be spoken of further on), lixiviating and precipitating vats, and, finally, a refining furnace for the cement copper.

The smoke stack of the furnace should be furnished with a rose jet, spray wheel, or some other device for wetting down the escaping sulphurous fumes; while under or in close proximity to the furnace must be placed the lixiviating vat, which will contain, at the outset, a strong solution of salt and water, and into which will flow the water which has absorbed the fumes passing up the stack.

The manipulations would be to reduce the ore to the conditions of sand or powder, mix it with salt in proper proportions, and roast it in the furnace, and when the chlorination is effected (no sulphides must remain, but some oxide is not objectionable), to withdraw and throw it hot into the bath of the lixiviating vat.

The chlorides of copper formed in the furnace will be quickly dissolved by the saline solution *per se*, while the sulphurous acid, wetted down and returned to the vat (it should be wetted down with the vat solution), will decompose other portions of the salt and liberate the chlorine to convert the oxide into a soluble chloride. The solution should then be drawn off into the precipitating vats, and the copper precipitated by milk of lime. The refining furnace should then take charge of the precipitate.

It will be observed that there will be left in the precipitating vat a solution of chloride of lime; this may be returned to the lixiviating vat for the reception of the succeeding charge from the furnace (some salt always being added). The sulphurous gases from the stack, which are carried back to this vat, will precipitate the lime as an insoluble sulphate, and liberate the chlorine to act as before.

This is a brief outline of a process which seems to possess the merits of effectiveness, simplicity, and economy, and consequently is well worth the attention of those interested in copper ores.

Though correct in theory and apparently of easy practice, it will undoubtedly fail at the hands of ignorance; but a fair practical knowledge of the chemistry of metallurgy, combined with patience and skill in manipulation, will develop it, we think, into an economical process that will add greatly to the profits of the Western miner of gold and silver, and restore value to the almost numberless copper mines of New England and the Southwestern States.

CONFERENCE OF SWISS JURISTS AT GENEVA.

On August 20th last the Society of Swiss Jurists met at the University, Geneva, Switzerland, to discuss the question of the adoption of a national patent law.

Dr. Meili, of Zurich, who read the opening paper, took the ground that any patent law was unconstitutional, but advocated a change in the constitution so as to permit the passage of such a law, and spoke of its many advantages. He also thought that an examination preliminary to the grant was advisable.

Dr. Schreyer, of Geneva, followed with an elaborate address, wherein he warmly opposed a system involving such preliminary examination, admitting, however, the great desirability of the law itself.

In the general discussion that took place on the questions presented by the papers Mr. Morel, vice president of the Federal Tribunal, and Mr. Francis Forbes, of the firm of Forbes & Sage, of New York, favored the adoption of the law, instancing the successful working of the United States Patent Laws, and the rapid growth of useful invention, owing to the security afforded by the same. At the close of the debate it was unanimously resolved that "the Society of Swiss Jurists declares that the passage of patent, trade mark, and design laws in Switzerland is desirable;" but the question constitutional was not voted on.

The society then adjourned to a banquet at the "Hotel National."

THE "TRUE THREAD."

"It's nearly done," said Old Apple John. "All I have now to do is to find the true thread of a quarter inch screw, and my work is completed, and the world will be turned upside down."

Then the old man retired to his cellar, and did not return to his apple stand. The neighbors went to look for him. The cellar was still, but a dim lamp burned at mid-day in the inner room. The doors were forced, and the old man was found dead upon a pallet of straw. The machine that was to go without power stood on the table; but it lacked the "true thread."

For years the old man had worked upon the machine, spending upon it all his spare time and slender income, bearing patiently poverty, contumely, discouragements, disappointments; returning to the counsel of friends and the jeers of acquaintances, the single reply that when one more obstacle was overcome his perpetual motion would be a fact; then he would be at the top of the heap, and have his laugh at those below. Of the principle he was sure; but the "true thread," or its many equivalents, forever eluded his grasp.

Strange what a hold that old idea has upon the human mind! The shadowy yet tantalizing belief that somehow something may be got from nothing—that by some trickery of mechanical device the universe may be cheated into yielding power without an equivalent return—seems to be an inheritance of the race, to be eliminated from the mental constitutions of individuals only by early instruction—or by death. So long as men are "sure of the principle"—and those who are sure are numberless—no disappointment, no accumulation of contrary experience, can convince them that the search for the "true thread" is hopeless. The impossible is to them a hope; it is always possible, and always lies just one remove beyond their reach.

These are the honest Apple Johns—the genuine seekers for the "true thread." Of a very different order is the man who has found the "true thread." He is invariably a rascal, and is after unearned money. So he deludes his victims with the promise of a grand prize sure to follow the investment of just enough money to make a larger and stronger model—just enough to start the Grand Turn the World Over Association on a solid basis. He shrewdly counts on the abundance of men of more cash than sterling sense; men who still harbor the delusive conviction that the "true thread," by which something will come from nothing, is discoverable, and that the first to find it will make no end of money by it: and he is not disappointed. There are men always ready to bet against the inevitable, provided some one confidently assures them that he has a trick to circumvent it: and until that race dies out the harvest of the swindler is sure. With the gambler's spirit they reap the gambler's ultimate reward.

It is amazing what protean shapes the "true thread" assumes, and how near it always hovers to the limit of the pursuer's reach. It is even more amazing that so many are in one way or another in hot pursuit of it, sure of the principle, but always baffled in its material realization.

A PROMISING FIELD FOR INVENTION.

Much cheaper machinery and other ironwork of many kinds might be manufactured, could the cost of turning and planing be considerably lessened, and extended, and even new markets might be developed, for it is this kind of work that adds largely to the cost of engines and all machinery driven by them.

In drilling, filing, and finishing, it is the tool that moves to produce the desired effect, not the mass of metal operated upon, and very marked would be the difference in power, to say nothing of the excessive time and labor that the reverse operation would involve.

By what epithet indeed would we nowadays designate the workman who would attempt, in all cases, to drill holes by using a stationary tool, and revolving the metal against it? And yet, practically, the present method of turning and planing in no wise differs from this.

Evidently incorrect in principle, this is one of those practices that remains in vogue, seemingly because the machines adopting it are such an improvement on what went before that little thought has been given to the possibility of still further advance, but whoever can supersede it by correct practice will hardly fail of ample reward.

The wood planer, by reason of its revolving at a high velocity, accomplishes its work with almost marvelous rapidity, and we can conceive of no reason why the same principle should not be applied to the turning and planing of metals.

It may, however, be urged against this that machine planed boards are not so smooth and true as metal work must be; but to this one may reply that the "spring" or "buckle" of the board is the cause of its unevenness, and that such objection will not apply to the working of metals in this way to any greater extent than it will to the present practice.

For the general work of turning and planing metals, especially for heavy work, there might be substituted for the present fixed tools rapidly revolving disks or cylinders of required diameters and thickness, and carrying cutters on faces or edges, as might be best adapted to the work, the disks or cylinders to be adjustable in horizontal or vertical planes, and at any required angles, and to be hung in swinging frames, so that their movement and pressure against the work may be easily regulated. The cutters or teeth should but slightly project, and should have broad bases to insure necessary strength and rigidity. With sufficient velocities, light tools of this character would easily accomplish work to which the present style is barely equal.

In the well known fact that a disk of thin sheet iron with smooth edge, revolving at high speed, will quickly cut through a bar of steel, we find assurance that the plan above suggested is entirely feasible. By adoption of it we think increased accuracy of work would be secured as well as great economies in steam power, time, and labor, and that simpler and lighter machines would be substituted for the present somewhat complicated lathes and planers.

With these few suggestions we leave the problem to our inventors to be worked out in all its details.

AMERICAN DEXTERITY.

Not long ago one of the largest and most successful shoe manufacturers in Europe stated that, though his factory was stacked with the best American machinery, and manned by as good a class of workmen as he could get, he was undersold at his own door by American makers. His observations in American factories supplied the explanation: the average workman in our factories, he said, could turn out much more work in a day than the most skillful in Europe, owing to their superior dexterity and quickness. The Swiss watch manufacturer, Dubied, said that the American workman could turn out day by day three or four times the average product of the European of the same class.

This seems like gross exaggeration; but it is not out of harmony with the testimony of many competent foreign observers. A correspondent of the British *Ironmonger* tells a story which furnishes an apt illustration of this feature of American workmanship.

He says that during the Centennial year an English manufacturer of stamped tinware saw some presses in use in this country which pleased him greatly. He was particularly struck with their rapidity of operation, and ordered three. They were made in due time, and the maker, hoping for other orders, took them abroad himself. They were set up, and men experienced with presses were given charge of them; but under the most favorable conditions they could not be made to turn out within forty per cent as much work as they averaged daily in American works. The operators were not quick enough. Here one man operated a machine unaided, and had a blank in position every time the die descended. In the English shop the operator had two boys to help him, one to handle the blanks, and the other to carry away the stamped article; but even with this assistance he could not supply the blanks fast enough, and forty out of every hundred times the die descended it had nothing to do.

The same writer observes that this is no uncommon experience with the makers of American machinery. Our most successful machines are often failures abroad simply because they are too fast for the workmen of other countries. Their operations are gauged by the average capacity of American artisans, and foreign operatives fail to keep up with them.

This is but another instance of the educative effect of machinery; and every year, with the increasing perfection of mechanical devices, the need of intelligence, precision, and rapid manipulation is increased. The intellectual development of skilled workers cannot but be advanced in consequence. Already the mechanic needs, and many of our mechanics possess, a higher grade of culture and vastly more knowledge than sufficed for the learned professions so called a few years ago.

CUBA AS A FIELD FOR ENTERPRISE.

Two circumstances combine just at this time to make Cuba an uncommonly promising field for American effort in the way of industrial development and trade—the revival of Cuban industry by the return of peace and the necessity of making good the property damaged or destroyed during the war, and the adoption by Spain of a liberal patent system. The tedious formalities and heavy costs, which have hitherto practically excluded inventors from this island by making protection difficult or unattainable, are now done away with, and with little trouble, for the single moderate fee of $100, the inventor can secure a patent covering not only Cuba and adjacent Spanish islands, but also Spain, the Atlantic and Mediterranean islands belonging to that rising power, and the Philippine Islands, in all perhaps the most promising field for industrial exploitation that the world affords.

By taking the precaution to apply for a Spanish patent before taking out his final papers here—say after the patent has been allowed, but before it is issued—the inventor may secure protection for his invention for twenty years. If he delays the application until his American patent has been issued, but not longer than two years thereafter, the Spanish patent will be granted for ten years only.

These to inventors. In addition, patents for five years are offered for the introduction of novelties into the Spanish dominions, whether the introducer be the inventor or not.

Already a considerable number of American inventors have shown their appreciation of the increased advantages offered by the new law; and doubtless many more, including manufacturers as well as inventors, will hasten to avail themselves of the new fields of enterprise and profit thus laid open. For many years, if not forever, Cuba must be a large buyer and not a producer of machinery and manufactured articles. Of this trade the United States should have, and can have, the lion's share.

AN INVENTOR'S DIFFICULTIES IN ENGLAND.

In a letter to a friend in this country, Mr. Graham Bell, the inventor of the telephone, gives an amusing account of the difficulties he has experienced, while in England, in getting other than routine work done. He says:

"If you want to know the reason why inventors are more numerous in America than they are here, come and live for six months in England. If you wish to know how it feels to be brimful of ideas, and yet to be unable to have one of them executed, come to England. If you wish to know how it feels to have to wait for a month to have the simplest thing made, and then to be charged a man's wages for two months, come to England.

"You will here be unable to see the interior of a workshop or to come into direct contact with your workmen, and the people seem incapable of working excepting in the ruts worn out by their predecessors. They are absolutely incapable of calculating any new design without the most laborious oversight from the inventor, and their masters, instead of encouraging invention, do all they can to put a stop to it, by refusing admission to the workshops, and charging the most exorbitant prices for experimental work, avowedly because they 'don't want such kind of work,' 'it gives more trouble than it is worth,' and 'if you must have new things made you must expect to pay for them.' It is in vain that I say I have no objection to pay if I can only be allowed to oversee my own work. It is in vain that I say I am willing to pay anything to have my work done, and that what I object to is having to pay for not having it done. It is the same everywhere. Not only is your work not done, but you have to wait so long for the simplest things that your ideas cool, and you get quite exasperated at your inability to do anything."

It would be interesting to know whether inventors in other fields are similarly hindered. Just now it seems to be especially difficult, for any one not connected with or favored by the English Telegraph Department, to get anything done in the way of telephones or telegraphy. Possibly that is the source of Mr. Bell's troubles.

The Secret of Soap and Water.

Hitherto no satisfactory reason has been given why for cleansing purposes the comparatively neutral soap should be better than the alkaline carbonate. In a note on the pedetic action of soap, Professor W. Stanley Jevons offers a plausible solution of the mystery. He finds by experiment that pedesis, or the so-called Brownian movement of microscopic particles, is considerably increased by the addition of soap to water, and to this action he attributes the detergent effect of soap. Pure rain or distilled water has a high cleansing power, because it produces pedesis in a high degree, the minute particles of dirt being thereby loosened and washed away. The hardness of impure water arises from the vast decrease of pedesis due to the salts in solution: hence the inferior cleansing power of such water. If alkaline salts be added, dissolved in the water, it becomes capable of acting upon oleaginous matter, but the pedetic action is lessened, not increased. But if soap be added we have the advantage both of the alkali's dissolving power and the pedetic cleansing power. For the same reason silicate of soda is a powerful cleanser, it being one of the few substances which increase the pedetic and suspensive power of water.

THERE is said to be a terrestrial globe in the Jesuitic Library of the Lyons Lyceum, which is 170 years old, containing, in great detail, the curious system of African lakes and rivers, which the English and American travelers have lately rediscovered. It is two meters in diameter, and an inscription, near the north pole, states that it was made in the year 1701, by F. F. Bonaventure and Gregoire, Brothers of the Third Order of St. Francis. The globe has created a great sensation among geographical savants and amateurs.—*Les Mondes.*

More Beer and Less Whisky.

According to the internal revenue returns, the citizens of the Republic are drinking less whisky and more beer. Whisky—that part of it which paid revenue tax, at least—fell off from 57,000,000 gallons for the fiscal year of 1877 to 50,704,000 in 1878—a difference of nearly 6,300,000 gallons. For the same time, the revenue-paying beer increased from 9,480,000 barrels to 9,937,000 barrels—an increase of 457,000 barrels, or 1,371,000 gallons. During the last 10 or 12 years, if not longer, there has been a perceptible diminution here, considering the ever-growing census, in the consumption of whisky and others liquors, and a corresponding increment of beer, as is shown by a decrease in drunkenness and its attendant ills.—*New York Times.*

Engineering Inventions.

An improvement in Gearing has been patented by Mr. W. J. McDougall, of Kendall Creek, Pa. This invention consists in the combination of two or more sets of three or more cranks, loose wheels, and flexible connecting wires or wire ropes for transmitting motion from the driving power to the machinery to be driven.

An Electric Railway Car Signal has been patented by Messrs. Carl L. Meos and Israel A. Sherman, of Louisville, Ky. This invention consists in combining a signal device upon the locomotive with two circuit wires extending through the cars of the train, and with peculiarly constructed circuit - breaking connections extending from one car to the other, whereby the parting of the cars, or any one of them, automatically transmits to the engineer a signal to that effect.

Messrs. L. S. Chandler and Samuel N. Silver, of Auburn, Me., have patented an improved Engine which may be used as a water engine, a stationary or locomotive steam engine, a water pump, a steam pump, or a steam fire engine. It is simple, effective, and will work without pounding or back pressure.

The Order of Mental Progress Science-ward.

In summing up the points of his review of what we may call the evolution of science, before the Science Association at St. Louis, August 22, Prof. Newcomb traced the gradual ascendency of scientific over teleological thought, as follows:

First, When men study the operations of the world around them, they find that certain of those operations are determined by knowable antecedent conditions, and go on with that blind disregard of consequences which they call law. They also find certain other operations which they are unable thus to trace to the operation of law.

Secondly, Men attribute this latter class to anthropomorphic beings, or gods having the power to bring about changes in nature, and having certain objects, worthy or ignoble, in view, which they thus endeavor to compass. Men also believe themselves able to discern these objects, and thus to explain the operations which bring them about. The objects aimed at by these supernatural beings are worthy or ignoble, according to the state of society; in ancient times they were often the gratification of the silliest pride or the lowest lusts.

Thirdly, As knowledge advances, one after another of these operations are found to be really determined by law, the only difficulty being that the law was before unknown or not comprehended, or that the circumstances which determined its action were too obscure or too complex to be fully grasped by the mind.

Fourthly, Final causes having thus, one by one, disappeared from every thicket which has been fully explored, the question arises whether they now have or ever had any existence at all. On the one hand it may be claimed that it is unphilosophical to believe in them when they have been sought in vain in every corner into which light can penetrate. On the other hand we have the difficulty of accounting for these very laws by which we find the course of nature to be determined. Take, as a single example, the law of hereditary descent; how did such a law, or rather, how did such a process, for it is a process, first commence? If this is not as legitimate a subject for inquiry as the question, How came the hand, the eye, or the first germ into existence? it is only because it seems more difficult to investigate. If, as the most advanced scientific philosophy teaches, creation is itself but a growth, how did that growth originate? We here reach the limits of the scientific field, on ground where they are less well defined than in some other directions; but I shall take the liberty of making a single suggestion respecting a matter which lies outside of them. When the doctrine of the universality of natural law is carried so far as to include the genesis of living beings and the adaptations to external circumstances which we see in their organs and their structure, it is often pronounced to be atheistic. Whether this judgment is or is not correct, I cannot say, but it is very easy to propound the test question by which its correctness is to be determined: "Is the general doctrine of causes acting in apparently blind obedience to invariable law in itself atheistic?" If it is, then the whole progress of our knowledge of nature has been in this direction, for it has consisted in reducing the operations of nature to such blind obedience. Of course, when I say blind, you understand that I mean blind so far as a scrutable regard to consequence is concerned—blind like justice, in fact.

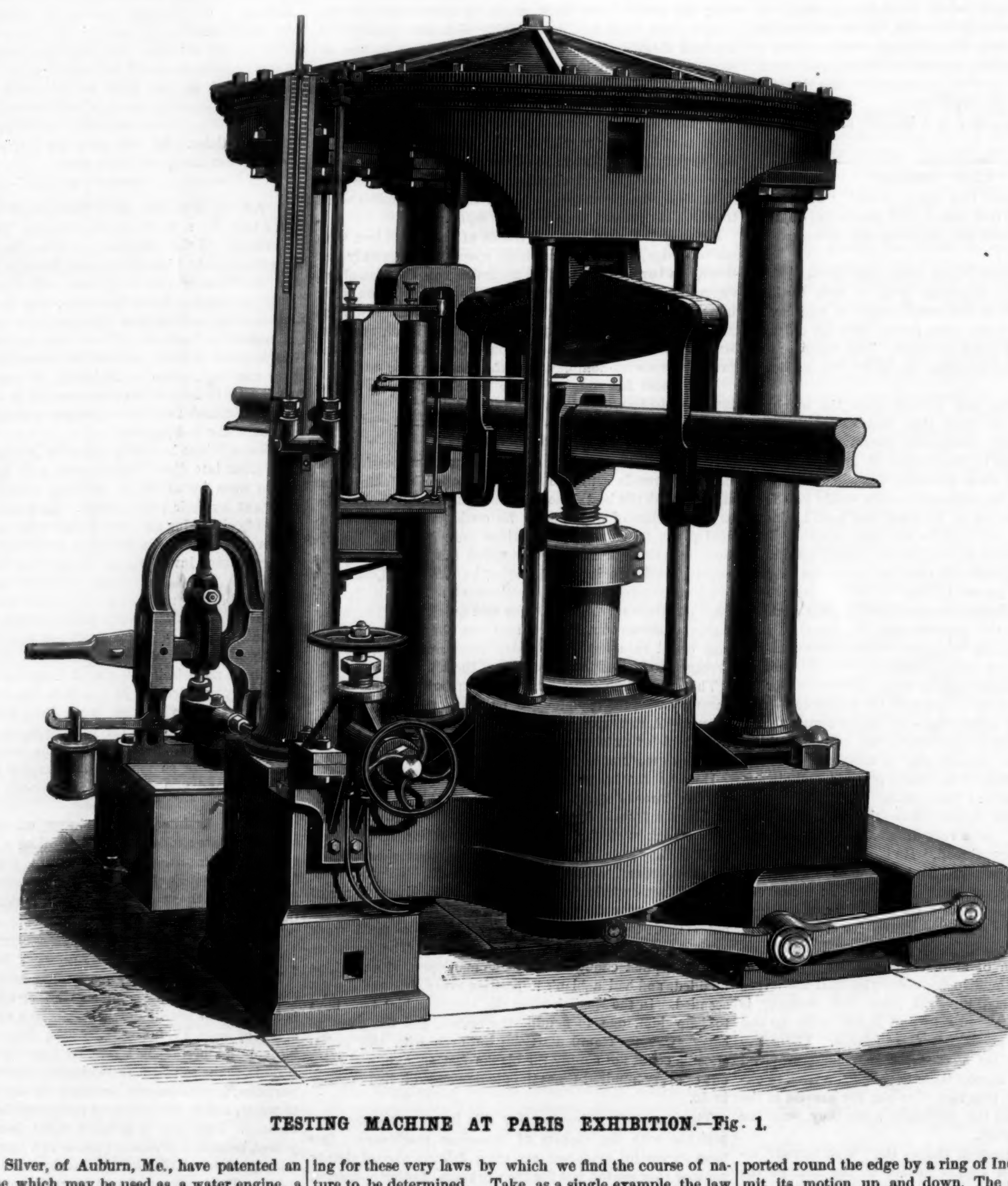
If the doctrine is not atheistic, then there is nothing atheistic in any phase of the theory of evolution, for this consists solely in accounting for certain processes by natural laws. I do not pretend to answer the question here involved, because it belongs entirely to the domain of theology. All we can ask is that each individual shall hold consistent views on the subject.

TESTING MACHINES AT THE PARIS EXHIBITION.

Messrs. Chauvin & Marin-Darbel, of Paris, have somewhat numerous exhibits of their manufacture at the Exhibition, among the rest some testing machines of a type which they brought out in 1876, and which we illustrate by the engravings on the present and opposite pages, for which we are indebted to *Engineering.*

Fig. 1 represents a 60-ton machine for tension, compression, and bending, shown in the engraving as arranged for bending stress. Fig. 2 shows the apparatus used for registering strains in the same machine when it is used for extension or compression. Fig. 3 is a machine for testing wire, and Fig. 4 a machine for testing paper, woven fabrics, or threads. All these machines act on the same principle, which may easily be described by the help of Fig. 1. Attached to the entablature of the machine, which is supported by three cast iron columns and two smaller ones of wrought iron, is a cast iron cover, slightly conical. Below this cover is a similarly shaped diaphragm, supported round the edge by a ring of India rubber so as to permit its motion up and down. The diaphragm fits up into the cover so that only a small space is left between the surfaces of the two. This space is filled up with water, all the air being carefully expelled from it. The lower portion of it is then put in communication with a bent tube filled with mercury, the outer end of which is open and stands above the level of the top of the machine, as shown attached to the left hand column in Fig. 1. It will be readily understood that under these conditions the separation of the diaphragm and the cover, that is to say, the pulling down of the former, is resisted by the atmospheric pressure from below. As the separation is effected the mercury passes from the tube into the space between the two surfaces, and the depression of the level of the mercury forms a measure of the amount of separation which has taken place, and hence of the force which must have been exerted to cause that separation.

Underneath the diaphragm, and connected with it at the center, is placed a lever, one end of which is fixed and the other attached to the object to be tested. In Fig. 1 this attachment is made to a second lever carrying hanging links and knife edges for the rail which is to be bent. The lower end of the test piece (or, as in Fig. 1, the center of the bar



TESTING MACHINE AT PARIS EXHIBITION.—Fig. 1.

to be bent) is connected to the upper end of a hydraulic ram, the cylinder for which forms part of the base plate of the machine. The ram and parts connected with it are balanced by a counterweight carried by levers, shown to the right of Fig. 1. The load is applied to the test piece, as usual, by simply pumping water into the ram cylinder, and so forcing down the ram. At the side of the column of mercury are scales on which the alteration in its level can be read, the one being marked in kilogrammes simply, the other in kilogrammes per square millimeter. The scales are movable, so that the zero point can be adjusted at each experiment to the level of the mercury, which must, of course, alter with the weight of the piece to be tested. The scales are determined by calculation and verified by actual application of weight to the diaphragm. Somewhat primitive apparatus is attached for recording deflections (Fig. 1) and alterations of length (Fig. 2). It is assumed, at least in the former, that the whole drop of the diaphragm is too small to be worth measuring. The machine is made in four sizes, namely, 15, 30, 60 and 100 tons; that exhibited at Paris is for 30 tons.

The machine shown in Fig. 3 is for a maximum load of 2 tons, the same type being also made for 5 tons and for 10 tons. The entablature is here supported by two columns only, and the effort is applied by hand gearing instead of by a pump. The lever under the diaphragm is also dispensed with, the wire being attached directly to its center. The neat little machine for paper, etc. (Fig. 4), is, of course, simpler still; in it one of the columns is made to inclose the mercury gauge. Its maximum load is 30 kilos.

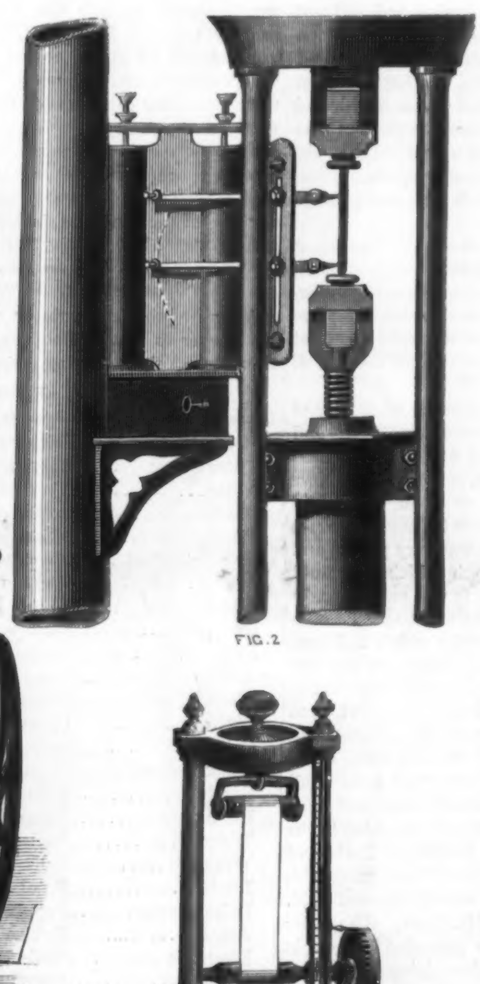


FIG. 2

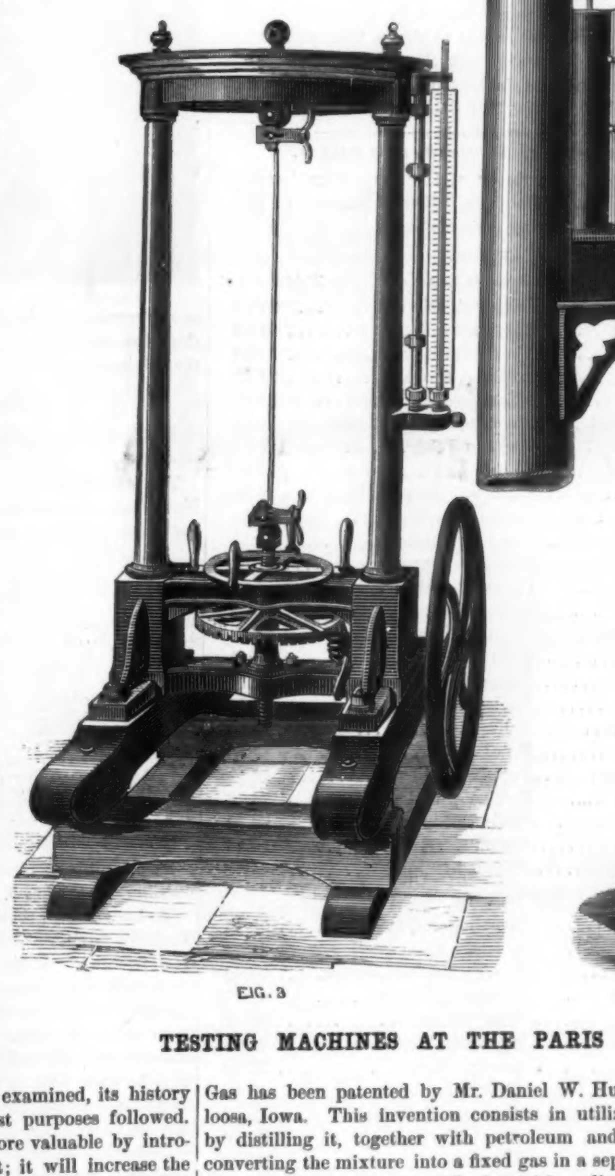


FIG. 3

FIG. 4

TESTING MACHINES AT THE PARIS EXHIBITION.

The Study of Common Things.

Speaking of the grievous neglect of attention to common things and common employments as means of education, the Philadelphia *Public Ledger* sensibly remarks that "it is in the study of common things, that are so plentiful all around us, but so little understood, that an education may be gained of which at present we have only begun to conceive. Schools are numerous, books are abundant, every child is now made master of the elements of learning, yet there is a lack of practical education; the effects of the school are apt to fade away on the farm and in the factory, and a separation, if not an antagonism, often takes place between study and daily life. We need a bridge which will carry the scholar with his habits of study and inquiry safely into the life of profitable labor, without obliging him to drop what he has taken so much pains to gain. Such a bridge may be found in the study of common things. Ordinary life pursuits furnish abundant material for such study. Every object we see or handle in every-day life has a history well worth perusing, a composition well worth analyzing, a future well worth conjecturing. However common it may be, it has that in it, and about it, which will forever prevent it from being commonplace. Every employment we engage in, however mechanical or insignificant it may seem, will escape from all such odium if it is pursued with an active brain as well as a busy hand—if its resources are examined, its history studied, its methods compared, its best purposes followed. Such education will make labor far more valuable by introducing into it the element of thought; it will increase the power of observation, and stimulate the curiosity, which is the germ of all knowledge; it will invest the world of common things with richer meaning and keener flavor; and best of all, it will give continual occupation to those higher faculties of man which are apt to rust in the tame routine of every day life, when not thus lifted out of the region of commonplace."

New Inventions.

An improved Mechanical Telephone has been patented by Messrs. Schuyler S. Parsons, Francis R. Shaw, and George N. Daniels, of Chatham Center, Ohio. This invention consists of a diaphragm of cloth or other textile fabric, mounted in an open wooden case. The transmitting wire branches out into a number of smaller wires, jointed to the main wire and attached to the diaphragm. The main wire is hung to insulators, made of sheepskin, placed in a frame with a central opening, the frame and sheepskin being slitted, and the latter re-enforced at the slit.

An improved Checking Device for Horses has been patented by Mr. Joshua Davies, of Muskegon, Mich. This invention is designed to furnish for horses an improved adjustable check by which the head of the horse may be retained at any point and checked or unchecked with great facility from the driver's seat.

Mr. David S. White, of Tolono, Ill., has devised an improved Folding Chair, suitable for an ordinary chair, an arm chair, and a rocking chair, which may be changed from one to the other without lessening the feasibility of folding it up to occupy a small space.

Mr. Jacob L. Friedriech, of West Branch, Mich., has patented an improved Bag Holder. The object of this invention is to provide for quickly and readily attaching a bag to a hopper or spout, or detaching the same, and adapting the holder to various sized bags.

Mr. Benjamin F. Sellers, of Garden Prairie, Ill., has patented an improved Barb Winder, which consists in the combination of a pair of double holding jaws for retaining the fence and barb wires, a revolving spring-pressed mandrel or head, having a hooked coiling head and adapted to receive the fence wire, a forked bar forming a bearing for the coiling mandrel, and a forked handle or crank for rotating the coiling mandrel.

An improved Process for the Manufacture of Illuminating Gas has been patented by Mr. Daniel W. Hunt, of Oskaloosa, Iowa. This invention consists in utilizing coal tar by distilling it, together with petroleum and steam, and converting the mixture into a fixed gas in a separate hot retort, and mixing this gas while hot with ordinary coal gas. The vapors of the oil and tar mingle with the gas from the coal and with the decomposed steam, and unite and form a fixed gas of a high illuminating power.

Mr. Philip Lamboy, of Schenectady, N. Y., has patented an improved Broom Handle. The upper end of the handle is turned down smaller than the main portion, to receive the tube or sleeve, which may be of wood, paper, or metal, and of sufficient length to be grasped readily by the hand. In use the sleeve or revolving portion is grasped by the hand, and the broom can be turned without moving that hand, thereby facilitating the labor of sweeping.

An improved Cake Griddle has been patented by Mr. Jonathan V. Taylor, of Lansingburg, N. Y. The fixed plate is provided with raised lugs, on which the hinged plate is supported, so as to admit air to the cakes dumped by the swinging plate. The hinged plate is also provided with a hinged handle, that is retained by a projecting shoulder in upright position, and which admits the swinging over of the hinged plate without inconvenience.

Mr. John N. Valley, of Jersey City, N. J., has patented an improved Spring Bed Bottom. The object of this invention is to provide an improved and adjustable elastic bottom for beds, and in which the tension of the springs may be varied to suit the weight of the occupant.

An improved Combined Thill and Harness has been patented by Mr. Royal B. Boynton, of West Townsend, Mass. The object of this invention is to furnish improved means for connecting a horse to the thills, so as to relieve the horse from any pressure around his chest which might interfere with his breathing and circulation.

Mrs. Henry Dormitzer, of New York city, has recently secured improvements on a previously patented Window Cleaning Step Chair. These improvements consist in a folding auxiliary step connected with the chair bottom or platform, which facilitates the cleaning of the upper part of the window; and also in a novel arrangement of eccentrics for clamping the chair securely in place.

New Mechanical Inventions.

Mr. Henry C. Strong, of Mauston, Wis., has patented an improved Saw Gummer. This is a time and labor saving machine for cutting, gumming, and shearing saw teeth. It may also be used as a punch.

Mr. Ignatz Frank, of New York city, has patented an improved Machine for Cutting Roll Paper, to be used as telegraph paper, ribbon paper, hat binding, and for other purposes, the machine accomplishing the cutting of a number of strips at the same time, and winding them on a mandrel.

Messrs. George L. Carlton and George H. Crager, of Omaha, Neb., have patented an improved Locking Hinge for Sleeping Car Berths. This invention is particularly intended for use in connection with a folding berth in a sleeping car, but is applicable to other cases where a bolt and hinge are employed in connection with each other. The principal object of the invention is to provide means for locking the folding portion of a berth and holding it securely in place when the berth is open for use; and also, under certain circumstances, when closed, to hold it sufficiently fast to prevent it from being accidentally displaced, but allow it to be readily opened, when desired, by the attendant or the occupant.

Mr. John C. Lewis, of Charlottesville, Va., has patented an improved Nut Lock, which consists in combining a leather or other soft or elastic washer with two nuts having adjacent ratchet faces, and arranged respectively upon right and left threads on the bolt, the leather washer being first wetted to soften it, and then compressed between the ratchet teeth of the nuts, so that the two nuts are rigidly connected and both prevented from turning.

An improved Machine for Dressing Printing Type has been patented by Mr. Thomas Mason, of 14 Cross street, Islington, Great Britain. This is a machine having reciprocating files, which dress the sides and edges of the type. It also consists in a device for feeding the type from one set of reciprocating files to another, and also in a device for nicking the bottom end of the type.

Mr. John H. Kersey, of Columbus Junction, Iowa, has patented a Mechanical Movement for driving light machinery, such as circular saws, small thrashing machines, churns, cider mills, etc., or for propelling boats, vehicles, street cars, etc.; and the invention consists of the combination of two or more operating and transmitting levers and crank rods with a compound crank shaft, and with means for transmitting the motion from the same.

Mr. George B. Hall, of Fort Plain, N. Y., has patented an improved Peanut Roaster, which consists in a novel arrangement of a stationary outer cylinder, a revolving inner cylinder, and driving mechanism, whereby provision is made for rotating the inner cylinder above a kerosene stove or other heater, and for thoroughly roasting the contents of the inner cylinder.

Brain Capacity.

At a recent meeting of the British Association, Professor W. H. Flower read a paper "On the Methods and Results of Measuring the Capacity of Crania." Of all the measurements by which they could determine the difference between the human skulls of people of one race and of a foreign race, perhaps the most important was that which gave the cubic capacity of the great cavity of the skull which contained the brain. Many ways of ascertaining it had been tried. Some persons laid great stress on the weight of the brain, but for his part he thought that on the whole if the capacity of the skull could be got it would be more valu-

able. The weight of the brain differed very much according to the age or physical conditions of the person when he died, and there were certain diseases which went to increase the specific gravity. But when the actual capacity of skull was found they had the actual capacity of the brain at the time of health.

There was another very important reason why they laid stress on obtaining the capacity of the crania in preference to the other method. It was because all their museums now contained a number of skulls from different parts of the earth, some of which were very inaccessible to scientific observation, and it was, of course, impossible to ascertain the actual weight of the brains of these people after death.

Then, again, how could they get the capacity of the skull by the weight of the brains in cases where the races had become extinct, such as the Tasmanians, many of the Polynesians, the ancient Britons, and the ancient Irish, and others, specimens of whose skulls they possessed, and by which they could ascertain the capacity of the brain? He supposed he would be expected to say at once whether he attributed any great and direct importance to the weight and age of the brain as an indication of intelligence. Well, he thought it was one of the very many points that had to be considered in this question; but he thought there were a great many other things to be remembered in this view of the question. For instance, many people had large brains and did not know how to use them, and some who knew how to use them did not try to do it. They would see that many of the races that were naturally considered the higher races, and had taken the lead in the civilization of the world, had undoubtedly larger cranial capacities than the peoples who were at the bottom of the ladder of civilization. He would never accept the mere fact of a man's head being large as an indication of superior intelligence, but it was one point to be considered.

The measurement of the skull was not only an important but it was also a difficult work, more difficult in fact than a great many people supposed, and a great many of the uncertain results that had been obtained on this subject were owing to the persons who had taken the matter in hand not having yet discovered the best and most certain method of carrying out the investigation.

A large number of measurements published were only of an approximate value, owing to the numerous fallacies and difficulties experienced in arriving at a satisfactory method of measurement. Nothing, apparently, could be easier than to take a skull and stop the cavities, and pour some fluid into it, and then pour it out and measure it; but they could not do this with the skull, as the bone was very porous and full of minute invisible holes, through which the fluid soaked as it would through a sponge. It was only by making the skull waterproof that they could seek to measure its cavity by a fluid. He had a skull by him which had been so prepared. The large holes had been filled with wax and the skull soaked in melted paraffin, which filled up the minute cavities, and when it was cooled it was as impervious to any fluid as delft. But the materials that had to be used in testing the capacity of the skull must be something solid. Various things, such as shot, grain, etc., had been used. He would pass over the various methods that had been tried and failed, and which would be found recorded in the *Transactions* of the Anthropological Society of Paris, and speak of two methods which, at the present time, meet with the greatest amount of success. One was the method of M. Broca, and the other the method of Mr. Busk. The latter had shown such good reasons for his plan that he thought it particularly safe to try it, and after doing so he had adopted it with some modifications. He filled the skull with mustard seed well shaken, and pressed in with the thumb, and then poured the seed into a long wooden box with glass sides, in which it was well shaken and pressed down. The figures on the glass indicated the spaces filled. This he thought was the most satisfactory way as yet invented, and they could hardly hope for better. He always kept his experimental skull by him when measuring other skulls, in order that he might occasionally go back to it to see if he had gone wrong.

Now, as to the measurement of the skulls of the different races of the human family, a very important point to consider, and a very difficult one, was the sexes, because there was a great difference in the size of the skulls; a much greater difference than there was between men of different races. To get the average of any race they must get a large number of skulls, and he must say their collection was very insufficient at present. According to a comparison between the skulls of sixty-three men of various races, and skulls of twenty-four women, the ratio of the woman's skull to the man's was as 854 to 1,000. The largest normal skull he had ever measured was as much as 2,075. He knew nothing of its history. It might have been the head of a great philosopher, but unfortunately they were not in the habit of getting the heads of philosophers in their museum. Nearly all the English skulls were those of persons in the lowest ranks of life. It was these they had to compare with the specimens of other races. The smallest head he had measured was 960 centimeters, and that belonged to one of those peculiar people in the center of Ceylon, who were now nearly extinct. The largest average capacity of any human head he had measured was that of a race of long, flat headed people on the west coast of Africa. The Laplanders and Esquimaux, who were a very small people, had very large skulls. The latter gave an average measurement of 1,546. He then came to the English skull, which was nearly the same size—1,542; but, as he had said, they belonged to the lower grades of English skulls. He could not tell them anything about Irish skulls, for there was not a single specimen of the Irish skull in any London museum. The inhabitants of the Canary Islands give a capacity of 1,498; the Japanese, 1,486; the Chinese, 1,424; the modern Italian, 1,475; the ancient Egyptian, 1,464; the true Polynesians, 1,454; negroes of various kinds, 1,377; the Kaffirs, 1,348; Hindoos, 1,306. They then came to the Australian aborigines, who were among the smallest, only giving an average of 1,283. There were two races still below the Australians, namely, the Andamanese, who were a very diminutive people, with a capacity of 1,220, and the Veddahs, of Ceylon, who had an average skull.

The President (Professor Huxley) said he might, without hesitation, offer the best thanks of the Section to Professor Flower for the important and interesting paper he had just read. Persons not ordinarily occupied with scientific pursuits might not be aware of the amount of care that had to be taken when it was desired to do any good in scientific matters in obtaining data, which data would, when obtained, pack into the very smallest possible results. It would be seen what care was required to obtain measurements of the cubical contents of the skulls, and yet the whole of the labor, if Mr. Flower published his paper, as he hoped he would, would go into the space occupied by the three or four rows of figures. There was one very interesting question he wished to put to Mr. Flower—whether it was possible to establish not only a series of absolute measurements of the capacities of the skull, but also some kind of index of capacity in which can be expressed the ratio of capacity of the skull to the stature of the person to whom it belonged; or if it was impossible to obtain that, yet even to obtain such data as would show the relation between the contents of the skull and the length of the part of the skull which was, as it were, the foundation of the skull.

Paper Fiber from Woods and Plants.

According to the experience of the paper manufacturers, De Naeyer & Co., of Belgium, different sources of paper fiber furnish the following percentages:

WOODS.

Common Names.	*Scientific Names.*	*Yield Per Cent.*
Heath	Erica vulgaris	27·14
Filbert trees	Corylus avellana	31·50
Alder	Alnus glutinosa	34·30
Bamboo	Bambusa thonarsu	34·82
White pine	Abies pectinata	34·60
Horse chestnut	Æsculus hippocastanus	38·26
Oak	Quercus robur	29·16
White poplar	Populus alba	35·81
Red pine	Pinus sylvestris rubra	32·28
Elm	Ulmus campestris	31·81
Ash	Fraxinus excelsior	32·28
Black alder	Rhamnus frangula	37·82
Fir	Pinus sylvestris	35·17
Osier	Salix alba	29·50
Canadian poplar	Populus Canadensis	36·88
Beech	Fagus sylvatica	30·90
Pitch pine	Pinus Australis	31·08
Walnut	Juglans regia	26·52
Willow	Salix alba	37·82
Birch	Betula alba	33·80
Italian poplar	Populus Italica	36·12
Acacia	Robina pseudoacacia	34·10
Lime tree	Tillia Europea	38.16
Rattan	Calamus verus	29.19
Aspen tree	Populus tremula	35·00

HERBACEOUS PLANTS.

Camelina	Camelina sativa	29·16
Bent grass	Agrostis spica venti	45·82
Buckwheat	Fagopyrum esculentum	30·60
Marsh rush	Scirpus palustris	41·70
Banana	Musa ensete	31·81
Mateva	Hyphœne Thebaica	26·08
Oats	Avena sativa	35·08
New Zealand flax	Phormium tenax	32·71
Asparagus stalks	Asparagus officinalis	32·56
Marsh grass	Glyceria aquatica	38·80
Maize	Zea maïs	40·24
Reed	Phragmites vulgaris	41·57
Canna	Canna	20·29
Rye	Secale cereale	44·13
Giant nettle	Urtica dioica	21·66
Sugar cane	Saccharum officinarum	29·15
Barley	Hordeum vulgare	36·21
Sedge	Carex	33·86
Wheat	Triticum sativum	43·14
Fromenteau	Baldengera Arundinacia	46·17
Blue flag	Enodium cœruleum	40·07
Hop	Humulus lupulus	34·84
Canary grass	Phalari Canariensis	44·16
Wild broom	Spartium scoparium	32·43
Dog's grass	Triticum repens	28·38

The Whitehead Torpedo in Battle.

Admiral Porter, U.S.N., has but small regard for the torpedo most approved by European authorities. In his article on torpedo warfare, in the September number of the *North American Review*, he says:

"To show the unreliability of the Whitehead torpedo, I will refer to the engagement between the Peruvian ironclad Huascar and two British men-of-war. The Shah, one of the latter, sent a fish torpedo against the Huascar, which, seeing bubbles of air rising to the surface, avoided the machine, and it ran straight into a harbor near by; there, the compressed air being gradually expended, the torpedo rested quietly alongside a Dutch merchant vessel at anchor, with no power to do harm. The Dutch captain, seeing what he supposed to be a live fish alongside, got out his fishing tackle, but was disgusted at not getting a bite; only after several unsuccessful attempts with a harpoon did he discover the nature of his visitor. The Whitehead may, under certain circumstances, be a destructive instrument, but, owing to its erratic movements, it is liable in the heat of battle to prove dangerous to its friends. The torpedo vessel will, in the end, I am convinced, prove a most effective and certain means of offense, as its movements are at all times under the entire control of its commander, who can select his own time for attack and retreat."

THE RECENT ECLIPSE OF THE SUN.

Our engraving is from a photograph of the eclipse taken July 29 by Mr. J. E. Ender, of Yorkville, Ill. The photograph itself is a beautiful specimen of the art; and although

our engraver has done very well, still the picture does not show the delicate and interesting gradations of light which the original presents.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, October 5, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury rises	4 54 mo.	Saturn in meridian	11 00 eve.
Venus rises	4 45 mo.	Uranus rises	2 43 mo.
Mars rises	5 34 mo.	Neptune rises	6 45 eve.
Jupiter sets	11 43 eve.	Neptune in meridian	1 34 mo.

FIRST MAGNITUDE STARS, ETC.

	H.M.		H.M.
Alpheratz in meridian.	11 03 eve.	Procyon rises	0 19 mo.
Mira (var.) rises	7 27 eve.	Regulus rises	2 22 mo.
Algol (var.) in meridian	2 05 mo.	Spica	invisible.
7 stars (Pleiades) rise	7 13 eve.	Arcturus sets	8 24 eve.
Aldebaran rises	8 32 eve.	Antares sets	7 44 eve.
Capella rises	6 00 eve.	Vega in meridian	5 35 eve.
Rigel rises	10 39 eve.	Altair in meridian	6 47 eve.
Betelgeuse rises	10 24 eve.	Deneb in meridian	7 39 eve.
Sirius rises	0 44 mo.	Fomalhaut in meridian	9 52 eve.

REMARKS.

Saturn will be about 7° south of the moon early in the evening of October 9.

To the amateur telescopist it will be interesting to observe Jupiter's satellites October 9, from 6h. 55m. evening to 10h. 34m. evening. At 6h. 55m. evening the first begins a transit, and with small telescopes seems to disappear at Jupiter's eastern limb, larger ones being able to follow it in its passage across the disk. At 8h. 14m. its shadow also crosses the eastern limb, and follows the course of the satellite, and may be seen with a telescope of very ordinary power and aperture. At 9h. 15m. the satellite emerges from the western limb, and its shadow 1h. 19m. later. At 10h. 34m. evening, his satellites will be disposed as follows: The first is close to the western limb, its apparent motion being from the planet; the second is three times as far east as the first was west, and is approaching the planet; the third is twice as far east as the second, and moving from Jupiter; while the fourth is almost at its greatest distance from the planet east, being about four times the distance of the third and nearly stationary.

Roasted Table Salt in Intermittent Fever.

Les Mondes quotes from a Marseilles medical journal a simple remedy for periodical fevers, which has been used very efficiently for many years by Dr. Brokes in his journeys in Hungary and America.

The directions are to take a handful of powdered white salt, such as is used in kitchens, and roast it in a clean stove (new, if possible) with moderate heat till it becomes of a brown color, like that of roasted coffee. The dose for an adult is a soupspoonful dissolved in a glass of warm water, taken at once. It should be stated that when the fever makes its appearance at intervals of 2, 3, or 4 days, the remedy should be taken fasting, on the morning of the day following the fever. To overcome the thirst excited by the salt, but a small quantity of water should be taken through

a straw. During the forty-eight hours which follow the taking of the salt, the appetite should be satisfied with chicken or beef broth only; it is especially necessary at the time to observe a severe diet, and to avoid taking cold. The author asserts that during the eighteen years that he has used this method of treatment, he has never been unsuccessful. The remedy is certainly harmless, and perhaps worthy of a trial.

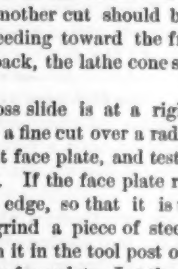
HOW TO TEST A LATHE.

To test if the cone spindle is parallel with the ways or shears, bore a long hole in a piece of cast iron, using a stout tool holder and a short stiff tool, taking a fine cut with a tool having its cutting edge slightly rounded, with a feed of 16 to an inch, at a speed of 25 feet per minute. Let the tool feed through the hole and back again, so that it may be definitely known that the tool does not spring away from the work. Then, without moving the tool from the cut, wind the tool to the entrance of the hole, and let it stand there while the lathe runs forty or fifty revolutions. Traverse the tool to the other end of the hole, and let it stand while the lathe runs again. Then stop the lathe and traverse the tool (without taking it from the cut) along the hole, and if it marks a line stronger at one end of the hole than at the other, the tool has sprung and another fine cut must be taken as before, but if not, and the hole is parallel, the spindle is true.

To avoid the wear of the tool it must be made as hard as possible. If the cut was started at the front and the hole bored is smallest at the back, another cut should be taken, commencing at the back and feeding toward the front. If the hole is still smallest at the back, the lathe cone spindle is not parallel with the ways.

To determine whether the cross slide is at a right angle with the ways or shears, take a fine cut over a radial face, such, for example, as the largest face plate, and test the finished plate with a straight edge. If the face plate runs true and shows true with a straight edge, so that it is unnecessary to take a cut over it, grind a piece of steel a little rounding on its end, and fasten it in the tool post or clamp, with the rounded end next to the face plate. Let the rounded end be about ⅛ inch away from the face plate, and then put the feed motion into gear, and, with the steel near the periphery of the face plate, let the carriage feed up until the rounded steel end will just grip a piece of thin paper against the face plate tight enough to cause a slight strain in pulling the paper out, then wind the tool in toward the lathe center and try the friction of the paper there; if equal, the cross slide is true.

In taking a cut down a radial face, to test the truth of the cross slide of the rest, the cut should be started from the periphery, for the following reasons: It is obvious that to some degree (however slight it may, under careful manipulation, be) the tool will become dulled as the cut proceeds. Now with an equal depth of cut, and under equal conditions, there is more strain and wear upon the tool edge when cutting the larger than when cutting the smaller diameter. Suppose, for example, that in the figure we have the radial face, A A, and that the tools, B and c, are each taking off a cut of $\frac{1}{16}$ inch deep having an equal feed; then from the lines, D E, we may perceive that the metal in the act of being severed by the tool, B, is much better supported by the metal behind it than is the metal being severed by c, and it follows that by beginning the cut at the outer diameter the strain upon it will get less, while the tool edge becomes duller, hence better results will be obtained than if the duty increased as the tool edge dulled.



To test the workmanship of the back head or tailstock, place the forefinger on the spindle close to the hub whence it emerges, and observe how much the hand wheel can be moved without moving the spindle; this will show how much, if any, lost motion there is between the screw and the nut in the spindle. Next wind the back spindle as far as it will go, take hold of the dead center and pull it back and forth, when an imperfect fit between the spindle and the hole in which it slides will be shown by the lateral motion of the dead center. Wind the dead center in again, and tighten and loosen the spindle clamp, and see if doing so moves the spindle in the socket. Wind the dead center out again and slide the tailstock up the lathe bed until the dead center nearly touches the live one, and after bolting the tailstock to the lathe bed, bring the center points close together and see if they coincide. If the tailstock sets over for turning tapers, the setting screws may be operated to adjust the centers.

In any event, the lathe centers should be of equal height, or the lathe will not turn true. It is as well to turn the back center partly in its socket while making this test, so as not to be deceived by any want of truth in the back or dead center.

To examine the slide rest, move the screw handles back and forth to find how much they may be moved without giving motion to the slides; this will determine the amount of lost motion between the collars of the screws and between the screws themselves and the nuts in which they operate. To try the fit of the movable slides in the stationary sliding ways or Vs, remove the screws and move the slide so that only about one half inch is in contact with the Vs, then move the slide back and forth laterally to see if there is any play. Move the slide to the other end of the Vs, and make a similar test, adjusting the slide to take up any play at either end. Then clean the bearing surfaces and move the slide back and forth on the Vs, and the marks will show the fit, while the power required to move the slide will show the parallelism of the Vs.

If the lathe carriage has a rack feed, operate it slowly by hand, to ascertain if it can be fed slowly and regularly by hand, which is of great importance. Then put the automatic feed in gear, and operate the feed gear back and forth, to determine how much it can be moved without moving the slide rest. To test the fit of the feed screw to the feed nut, put the latter in gear and operate the rack motion back and forth. It has been assumed in this method of testing that means of adjustment are provided whereby any play in the cone spindle bearings may be taken up. J. R.

THE STYLOGRAPHIC PEN.

For several years past Mr. A. T. Cross, a pen and pencil manufacturer of New England, has been engaged in perfecting a fountain pen, or more properly an ink pencil, which as now given to the public is certainly very useful and perfect. The holder or case, of vulcanized rubber, ornamented and beautifully mounted, contains the ink, which is conveyed by capillary attraction to the point, whence it flows easily and freely, in uniform and unshaded lines, over the paper.

For the past few weeks we have had some of these pens in practical use in the SCIENTIFIC AMERICAN office, and their working has so far proved very satisfactory. They write more smoothly and easily than a lead pencil, and can be used with facility upon any kind of paper. For long continued writing it is certainly a great convenience to take up one of these pens and be able to write page after page, for a whole day at a time, without being obliged to lift the hand from the paper, or resort to the inkstand, or change a pen, or sharpen a pencil. Our cut shows the exact size and form of the pen. Further information may be obtained from the New York general agent, Mr. C. W. Robinson, No. 107 Duane street, New York, or Mr. M. R. Warren, No. 21 Milk street, Boston, Mass.

An Accident on the Mt. Washington Railroad.

The machinery for arresting the motion of a train in case of accident on the Mount Washington Railroad was happily tested, not long since. While a train was ascending the mountain the rear driving wheel of the engine broke, whereupon the ratchet brake on the forward driving shaft of the engine was instantly applied, stopping the train so quickly and firmly that its movement backward down the slope was less than four inches. There were about seventy passengers on the train, and but few of them suspected that an accident had occurred before the train was stopped. No one was hurt.

London Lichens.

Hitherto the discoloration of London buildings has been chiefly attributed to the prevalent smoke and soot of the atmosphere of the city. It has been noticed, however, that other towns, with an atmosphere equally vile, and using the same sort of stone for building purposes, did not suffer in the same way; while, on the other hand, in places entirely out of the range of London smoke and soot, certain walls became as black as those of St. Paul's. These contrary conditions led Professor Paley to suspect that the discoloration might be of organic origin; accordingly he has made a careful study of the matter, resulting in the conviction that the mischief maker was in reality a minute lichen, irregular in shape and extremely low in organization. It thrives best on certain oolitic limestones much used in London, in warm shady places. The problem now is to find some means for killing and preventing the return of the lugubrious nuisance.

A Promising Western Town.

A correspondent of the *Daily Bulletin* prefaces a long account of the growing industries of Minneapolis, Minn., with the remark that Horace Greeley said, ten years ago, that the child was then living who would see the day when mills at the Falls of St. Anthony would produce more cotton goods than the mills of Manchester, and more woolen goods than the mills of Leeds. This was a big prophecy indeed, but as at that time Minneapolis and the village of St. Anthony, surrounding those falls, contained only about 15,000 inhabitants, and was a small manufacturing town, and has since swelled into a city of 47,000 inhabitants and become the largest flour milling city in the United States, and is still rapidly increasing its prominence in every respect, the prophecy was not so wild as it might seem; and its truth may yet be realized. It is not alone, however, the milling interest that has made Minneapolis. The one hundred thousand available horse power that has not yet been utilized is left after over 8,000 horse power of water has been used by nineteen flouring mills with 214 run of stone; a large woolen mill, manufacturing some of the finest blankets and cassimeres in America; a cotton mill making seamless bags, yarn, etc.; three iron works, a railroad machine shop, a mill machinery works, several planing mills, sash factories, two paper mills, two machine shops, a carding mill, a 300,000 bushel grain elevator, the city water works, twenty saw mills, many with immense gang saws, double circulars, etc.

Where Our Hardware Goes.

A correspondent of the British *Ironmonger* has been examining the monthly reports of our Treasury Department to see what becomes of exported hardware. He finds the destination of some of the principal articles to be as follows:

Nails are sent chiefly to Great Britain, Germany, France, Danish West Indies, British West Indies, Porto Rico, Cuba, Africa, British Guiana, Hayti, Columbia, Brazil, Mexico, Australia, New Zealand, and Canada.

Cutlery is sent chiefly to Great Britain, France, Cuba, Honduras, British Guiana, Columbia, Brazil, Mexico, Venezuela, and Australia.

Pumps are sent chiefly to Germany, Great Britain, France, Cuba, Columbia, Brazil, Venezuela, Australia, Mexico, New Zealand, Sandwich Islands, the East and West Indies, China, Japan, and many other countries.

Machinery is sent to Great Britain, Germany, France, Cuba, Hayti, San Domingo, all the South American States, Mexico, Central America, all parts of Europe, Africa, Australia, China, Japan, and elsewhere.

Articles classed as general hardware go to Great Britain, Norway, Sweden, Denmark, France, Germany, Spain, Italy, Russia, British North America, West Indies, East Indies, British colonies in Africa, British Guiana, China, Japan, all the South and Central American States, Australia, New Zealand, and many other countries.

Agricultural implements, clocks and watches, firearms, and many other manufactures, seem to go in greater or less amounts to nearly every country of the world.

Filtration of Sea Water through Sandstone.

Mr. Isaac Roberts, at a recent meeting of the British Association, stated that he was led to investigate the effects produced on sea water by filtration, in consequence of the constantly increasing salinity of the water drawn from several wells in Liverpool, which are sunk below the sea level in the Bunter sandstones of that locality. He found that one of the wells, which he selected as the type of the rest, yielded water which increased in salinity at the rate of 4·91 to 5·81 per cent annually, and inferred that the sandstone rock had the power of removing salts out of sea water. To prove this he filtered sea water through blocks of the sandstone, and found the inference to be greatly borne out by the results of his experiments. Two cubic feet of the stone removed, from the first filtrate of 3½ fluid ounces of the water, 80·8 per cent of the salts held in solution, and each measured quantity of four ounces, which were afterward filtered through, regularly showed an increase of the salts in solution, until 93½ fluid ounces had filtered through the stones. Then these ceased to be operative as filters, and the waters passed through unchanged. After allowing the stones to dry he passed the spring water through them, and found that the salts which they had taken up were again removed and washed out, thereby showing the action to be mechanical.

Miss Hosmer's Improved Sculptor's Model.

In a very appreciative account of Harriet Hosmer's "Sentinel of Pompeii," the London *Times* describes the ingenious method by which that artist overcomes the difficulties attending the use of clay models and casts. "To get rid of these," the *Times* remarks, "Miss Hosmer has devised the plan, after settling her design in the shape of a small model, of building up a rough model of the figure in plaster of Paris round a strong iron skeleton; on the surface of this she marks the more exact contour, after her small model, by steel points, such as are used in fixing the contour of a marble to be carved from a cast, and then works over the rough plaster, up to the heads of these points, in wax, applied warm, to a thickness varying from an eighth of an inch to nearly an inch, till she obtains the surface she desires, which in texture, color, and effect most closely resembles old marble.

"In this way is obtained a model which can be put aside at any moment and resumed when convenient, which can be preserved without liability to crack or shrink as long as may be desirable, and which bears the living impress of the sculptor's hand, like the clay, without the difficulty of keeping it in working order, and the liability to accident and disaster which beset the clay so sorely. How far these advantages outweigh any difficulties there may be in the preparation or working of the model thus treated, and what other advantages not here indicated the method may have, are, of course, questions for practical sculptors, to whom Miss Hosmer is ready to give full explanation of her new way of working."

In thus breaking through the immemorial customs of the art world, as in her womanly independence and energy, Miss Hosmer illustrates the true American spirit.

THE fiber of a variety of the aloe, peculiar to the Mauritius, is reported to be the best known material for ropes. It is said to be very pliant, to exceed in toughness an iron wire of the same size, and to be impervious to the effects of salt water

Suggestions for Fat People.

It is Brillat-Savarin, we believe, who, in his immortal book on gastronomy, avers that no one is entirely satisfied with his weight; every one wants to be somewhat fatter or somewhat leaner; or if he or she really is just about as he would be in this respect, he imagines a tendency one way or the other, which he feels he must be on his guard to correct.

There is enough truth in this to make it an object for that enterprising class of individuals who make their money out of the weaknesses of their fellows to advertise pretty constantly various secret fat producing and fat decreasing nostrums. The extraordinary sale of Banting's famous pamphlet, which reached sixty or seventy thousand copies, attests the same. And almost every year there is some new remedy offered to the regular profession, either to make fat or to disperse it.

The larger class, or, at any rate, apparently the more anxious class, are those who are too fat, and who wish to grow leaner. Of the various drugs proposed to accomplish this, acids, in the form of vinegar, and alkalies, especially liquor potassæ, are the best known. No doubt both these produce the effect desired, but they both do it at the cost of profound disturbances of the nutritive functions, and, in many cases, serious danger to life.

The *fucus vesiculosus* has been extensively lauded. It probably acts through the iodine in it, actively stimulating the secretory organs; and has, therefore, the injurious effects known in chronic iodism. We have seen letters from some who have used the extract to diminish their weight. The effect desired was produced, but the patients generally spoke of sensations of prostration, sinking, loss of appetite, etc.

The Banting system of diet has in many cases been tried with success, but it, too, carried out without intelligent knowledge of the patient's condition, has at times led to severe and dangerous disorders of the emunctories. In the case of a friend, of general fine health, and in early middle life, it has on several occasions, when he has tried it, resulted in rapid muscular debility and mental lassitude. In all such cases it should not be pushed.

Recently Dr. Tarnier has called attention (in the *Ann. de la Soc. de Med. de Gand.*, No. iv. 1877) to the success of a milk diet in these cases. He commences by allowing three fourths the usual food and one liter of milk the first day; one half the usual food and two liters of milk the second day; one fourth the food and three liters of milk the third day; and thereafter four liters of milk daily and nothing else.

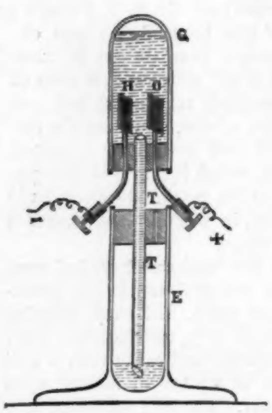
Often, however, it is better to allow a small proportion of the usual food each day, to prevent the patient becoming tired of the milk. Should diarrhea set in, the milk should be suspended for awhile, and then resumed. The treatment may be continued until the fat is reduced. Dr. Tarnier claims that this treatment is always successful, and entails no danger whatever.—*Medical and Surgical Reporter.*

Remarkable Echoes.

In the sepulcher of Metella, the wife of Sulla, in the Roman Campagna, there is an echo which repeats five times, in five different keys, and will also give back with distinctness a hexameter line which requires two and a half seconds to utter it. On the banks of the Naha, between Bingen and Coblentz, an echo repeats seventeen times. The speaker may scarcely be heard, and yet the responses are loud and distinct, sometimes appearing to approach, at other times to come from a great distance. Echoes equally beautiful and romantic are to be heard in our own islands. In the cemetery of the Abercorn family, at Paisley, when the door of the chapel is shut, the reverberations are equal to the sound of thunder. If a single note of music is breathed the tone ascends gradually with a multitude of echoes till it dies in soft and bewitching murmurs. In this chapel is interred Margery, the daughter of Bruce, and the wife of William Wallace. The echo at the Eagle's Nest, on the banks of Killarney, is renowned for its effective repetition of a bugle call, which seems to be repeated by a hundred instruments, until it gradually dies away in the air. At the report of a cannon the loudest thunders reverberate from the rock, and die in seemingly endless peals along the distant mountains. At the Castle of Simonetta, a nobleman's seat about two miles from Milan, a surprising echo is produced between the two wings of the building. The report of a pistol is repeated by this echo sixty times; and Addison, who visited the place on a somewhat foggy day, when the air was unfavorable to the experiment, counted fifty-six repetitions. At first they were very quick, but the intervals were greater in proportion as the sound decayed. It is asserted that the sound of one musical instrument in this place resembles a great number of instruments playing in concert. This echo is occasioned by the existence of two parallel walls of considerable length, between which the wave of sound is reverberated from one to the other until it is entirely spent.—*The World of Wonders.*

A Detonating Voltameter.

The following experiment, due to M. Bertin, is but little known, yet is exceedingly interesting, inasmuch as it puts on evidence certain phenomena connected with the polarization of electrodes which always take place under different conditions. The simple apparatus, represented in the engraving, consists of an inverted bell glass, G, closed with a cork, through which pass two platinum wires provided at their ends with broad plates, H O, of the same metal. It is supported by a glass tube, T, open at both ends, and fixed in the cork which closes the mouth of a test glass, E. Two wires from the batteries are connected with the platinum wires by means of ordinary binding screws. The bell glass, G, is filled with water acidulated with one-tenth of its volume of sulphuric acid. If this mixture be now decomposed by a strong current from a Bunsen battery of 50 elements, the water will be seen to lower very rapidly; and when the bell glass is almost full of gas, the mixture will detonate spontaneously, and be seen to take fire. This experiment is not attended with any danger whatever; the recomposition of the products of electrolysis takes place immediately, and during the passage of the current. It is necessary that this polarization current should have a certain tension; the phenomenon does not take place with a battery of 30 elements, but is at once spontaneously produced when the 20 elements that are necessary to make up the complement are added. With 30 elements, instead of a detonation there will be observed a phenomenon of a different nature, but none the less curious. The water, which at first lowers very rapidly to some millimeters below the platinum plates, all at once stops, in spite of the disengagement of gas on the wires. The plates recompose above what the wires decompose below.



By using pure water the decomposition takes place more slowly, and the detonation is not produced, even with 50 Bunsen elements. Still, a curious phenomenon is produced: the water lowers to the base of the plates, and then does nothing but oscillate between the base and top of these. The water is decomposed below and recomposed above. A weaker current, of 30 elements, decomposes the whole.

These curious phenomena are due to the polarization of the electrodes and not to the catalytic force of the platinum, for they may be obtained with electrodes of various metals.

Artesian Wells in England.

The lower greensand has just been penetrated at Her Majesty's Dockyard at Chatham, by a boring conducted by Messrs. Docwra & Son. The stratum was reached at a depth of 903 feet from the surface, and the water has risen so high as to overflow the top of the well. A year ago the boring had been carried down to a considerable depth in the chalk, when the character of the water was unsatisfactory, being brackish. The authorities at the Admiralty then consulted Professor Ramsay, the Director General of the Geological Survey, as to the probability of reaching the lower greensand if an attempt were made to penetrate the gault. The opinion given was decidedly in favor of the effort, the dip of the lower greensand in the Maidstone area being in the direction of Chatham. Professor Ramsay was also of opinion that the quantity of water to be thus obtained would be considerable. In accordance with this advice the boring was continued, and the anticipations expressed appear to have been fully verified, helping to throw further light on the geological aspect of the water supply in the southeast of England and the vicinity of the Metropolis. Some years ago Messrs. Docwra & Son tapped the lower greensand at Caterham, but as the boring was very small it became choked with sand. The lower greensand has also been found, somewhat recently, at Loughton, in the district of Epping Forest, about four miles southeast of Waltham, an ample supply of water being obtained from this stratum, at a depth of 1,092 feet.

Sea Sickness and its Treatment.

By a number of observers, nitrite of amyl in five drop doses is said to exert a favorable influence in sea sickness. A writer in the *Lancet*, Dr. J. R. Leeson, says, on the subject:

There are two theories about sea sickness: one that it is owing to the food tossing about in the stomach, and teasing it and the diaphragm with its jactitations, nausea and vomiting being the natural consequence; the other that the stomach has nothing to do with it, its cause being a congestion of the brain and cord, which acts in a reflex manner on the stomach. Those who hold the latter, of course, would expect great things from nitrite of amyl, and knowing, as we do, the marked effect it has on the "status epilepticus," one might become too sanguine. Which of these two theories is right I do not pretend to say, but I have an idea that most cases are due to a little of each, and that, with a loaded stomach and congested liver, we may expect but little from amyl; whereas in cases more purely nervous, especially as are seen in women, we have a very fairly successful remedy, and one that warrants much more varied and extensive trial than it has hitherto received.

Glycerine as an Anti-Ferment.

Mr. Munk states, in the *Chemical Journal*, that glycerine retards the lactic and alcoholic fermentations. One fifth of glycerine added to milk, at a temperature of 15° to 20° C., prevented it from turning sour for eight or ten days. One half or one third of glycerine, at the same temperature, postponed the fermentation of milk for six or seven weeks. At higher temperatures, larger quantities are needed to produce the same results.

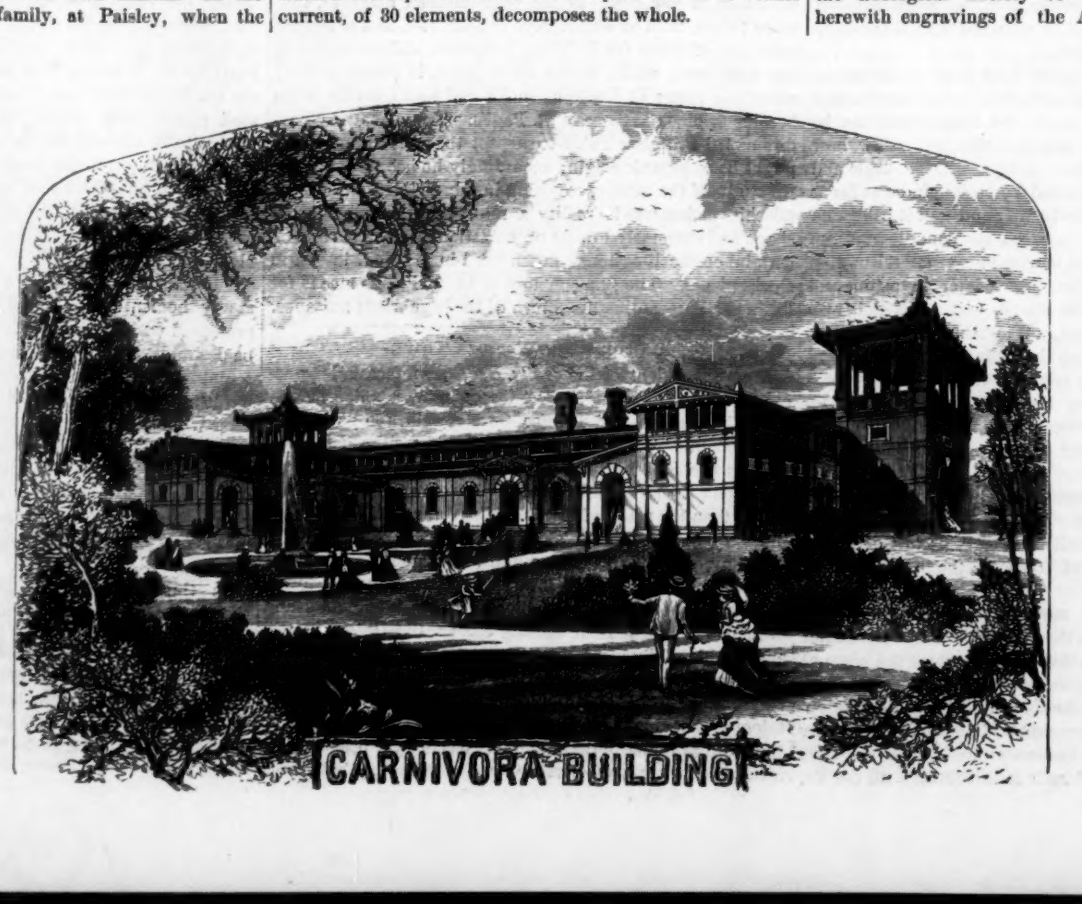
ZOOLOGICAL GARDEN AT FAIRMOUNT PARK, PHILADELPHIA.

In a recent issue we illustrated some of the buildings of the Zoölogical Society of Philadelphia, and we give herewith engravings of the Aviary, the Bear Pits, and the Carnivora Building. These, as well as the buildings previously described, are fine examples of architecture and fit ornaments for the noble park in which they are situated.

The Aviary contains many rare specimens of the feathered tribes from all parts of the world. The Bear Pits are constructed in accordance with the requirements of these peculiar animals, and are arranged to confine them while, at the same time, they afford facilities for the exercise of their climbing propensities.

In the Carnivora Building are found the lions, tigers, hyenas, leopards, and all of those animals that one prefers to see behind strong bars.

During the year which closed on the 28th of February last, there have been added to the collection of the Society 237 mammals, 149 birds, 109 batrachians,



and 192 reptiles, making the total number of specimens now living in the garden 1,008. Of this number 434 are mammals, 453 are birds, 58 are batrachians, and 63 are reptiles. The total valuation of these specimens is $57,623.

The Society numbers 960, exclusive of loan holders, and is holding its own notwithstanding the stringency of the times.

How Calicoes are Made.

The editor of the *New England Farmer* gives the following interesting description of his visit to Southbridge, Mass., and the Hamilton Woolen Company at that place:

Southbridge is a very enterprising town of nearly six thousand inhabitants, the majority of whom are engaged in some form of manufacturing. The Quinnebaug River passing through the town affords excellent water power, which is fully utilized. Steam power is also used to a large extent in several of the leading establishments. We were aware that our companion had used the influence of his *Journal* for a long time in trying to instill into the minds of his readers advanced ideas concerning the laying out and ornamentation of highways, and both public and private grounds, but we were hardly prepared to find in one of the central portions of the village quite a long row of fine residences on either side of the street, entirely unprotected by hedge or fence along the line of the street, nor do we often find a pleasanter street anywhere in our travels. The residences are really first class, are set back at such a distance from the street as to escape much of the dust and noise, and have neatly kept lawns in front, which are separated from the street by a light stone curbing, which simply defines the line where private property and the public thoroughfare meet. No hedge rows of brush or briers, no prison yard palings, obstruct the view or deface the beauty of the landscape. One needs only to witness such models of perfection in dooryard surroundings to fall in love with them on the spot, and well will it be when more of our village journals enlist in the work of cultivating an improved taste in this direction.

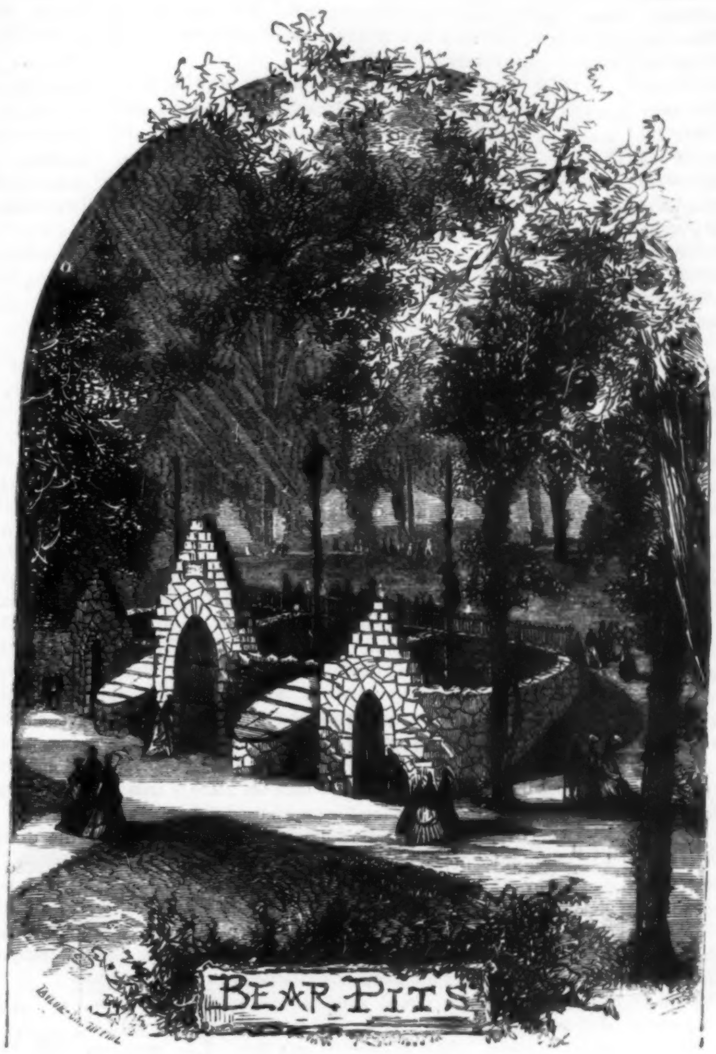
THE CALICO WORKS.

After dividing the night far too equally between the requirements of nature and the demands of the printer, the following beautiful morning found us in a mood for a visit to the great calico and delaine printing works of the Hamilton Woolen Company, a corporation with an assessed valuation equal to about one-third of the whole town, and giving employment to a very large proportion of the resident population. Obtaining a permit from the office and an introduction to Mr. Whitaker, superintendent of the printing department, we were shown through the acres of brick buildings used for carrying on the various processes required in changing plain, unbleached cotton and woolen cloth into beautiful and attractive dress goods. First, we were shown through the engraving department, where tons and tons of copper rollers are being engraved both by hand and by machinery, and fitted for giving the desired impression to the finished goods. The rollers are about three feet long, and, when new, some six inches or more in diameter, but as the fashions change, the figures are turned off, the rollers growing a trifle smaller at every change in the designs.

In the designing or pattern rooms are machines of the nicest workmanship for enlarging and transferring designs from paper to the copper rollers, requiring a high degree of skill in the attendants, who are chiefly girls, and who make good wages. Indeed, skill and faithfulness is well paid for almost anywhere, in any department of industry. Just how many names are upon the pay roll of the company we did not learn, but the number is very large, and the range of wages very wide. Men and boys stand here with their hands and feet in river water, pulling strips of cloth from one tub or vat into another, or simply watching and tending the machines which do most of the work, from morning till night, for wages which do not allow of many luxuries, nor should they be spent for foolish vices, though we notice that in too many cases the vices, as drinking and smoking, are first provided for.

Skilled workmen, especially those who run the printing machines, are well paid, the present rates being from twenty-five to thirty dollars per week, but the work is of the most difficult and perplexing character, except to the most skillful and long-trained mechanics. Five years is the shortest time allowed for learning to run one of these machines, and many would fail to learn in a lifetime, so nice and difficult is the work.

Let the reader imagine a collection of cast iron, copper, and steel, in the form of pulleys, shafting, cog wheels, and rollers, making a machine as large as a small corn crib, every part being so nicely arranged that, although the cloth to be printed passes alternately under the pressure of as many as eight or ten different copper rollers, each of which revolves constantly in a tray of thick coloring liquor, and with an arrangement of figures, flowers, and trailing vines almost as complicated and various in design as are the combinations in nature's field, yet each little touch of color comes to its exact position in the figure, with all the regularity and precision of the nicest clockwork, and at a rate of speed that will change clean white cloth to the most beautiful styles of prints, nearly or quite as fast as a horse will walk.



The coloring department is also a place of much interest, especially to a chemist, for every shade of color may here be found, adapted either to cotton or woolen fabrics, for different materials are required for different classes of goods. The cotton prints are, many of them, colored with dyes which require exposure to the air or to certain liquids, in order to bring out their hues.

No one visiting print works will fail to look into the singeing room, where the fine, loose fibers of cotton and wool adhering loosely to the cloth are burned off by passing the web first through a flame of burning gas, then over red hot iron rollers, from which the sparks fly off as from a blacksmith's forge. It is claimed that the cloth is not injured, and yet we all know that plain, unbleached cotton cloth grows no stronger or more durable from the many processes it passes through between the loom, the bleachery, the dye house, the printing and finishing rooms. Every operation gives it a pull or a twist, which only anticipates the pulling and twisting it will receive at the hands of the wearer, and yet calico, reps, and delaines are in better demand and bring higher prices than plain, brown sheeting, for the simple reason that man admires the beautiful and willingly spends his time, a portion of it at least, in adding beauty to utility. And it would almost seem that our faculty of discovering beauty in form and color was given us that we might thus innocently use what would otherwise be idle and wasted time, for were the efforts of mankind directed wholly to the production of plain food, and plain clothing and houses, one hour a day, with the aid of our labor-saving machinery, would probably supply all our needs; so we will not quarrel with those who cultivate a taste for the refined, the polished, and the beautiful, even though sometimes that taste is cultivated slightly at the expense of strength and durability.

Elks in Harness.

The St. Paul (Minn.) *Globe* describes the performance of a span of elks, recently on exhibition at a fair in that city. Their names are Dexter and Dasher; weight of each, about 500 lbs. They are two years old, well broken to harness, and the owner says they are so well trained that a woman can drive them. They were captured on Rice River, eight miles south of Fargo, Dakota, when four or five days old. It is an easy matter for them to travel sixteen miles an hour and have two men and a buggy, and it is said they can travel one hundred miles as easy as a horse team can fifty. This being true, these animals must be well worth domesticating.

One Way to Kill Moths.

Not long ago a large hotel was burned at Selma, Alabama, and during the burning a continuous swarm of moths from the cotton fields on the other side of the river, attracted by the light, poured into the flames. There were not thousands, but millions of them; and the volume did not diminish while the attraction lasted. Hundreds witnessed the scene, and all were surprised at the number of moths thus tempted to destruction. It is suggested that bright fires of brush or other waste material, during the season of moths, might be an effectual and economical means of getting rid of these pests, or rather their voracious and expensive offspring.

Gnoscopine.

The well known English chemists, T. and H. Smith, announce the discovery by them of an hitherto unknown alkaloid of opium, which they have named gnoscopine. This new principle is characterized by forming readily crystallizable salts, which have an acid reaction. That its salts possess this reaction, as also the fact that gnoscopine is quite insoluble in water, marks its strong resemblance to the papaverine group. Hence, also, it is easily separated from narceine which is moderately soluble in boiling water, and freely so in alkalies. Gnoscopine when pure is in the form of long, thin white needles, having a woolly character when dried. It is soluble in 1,500 parts of cold water, and melts at 233° C. It is insoluble in aqueous or in spirituous solutions of caustic soda, also in min-

eral spirit and fusel oil, but is soluble in chloroform and bisulphide of carbon, and slightly so in benzole.

Extraction of Steel and Iron from the Eye by the Magnet.

BY W. A. M'KEOWN, M.D.

The following cases will doubtless be of interest, taken in conjunction with that not long ago brought before the Clinical Society of London by Mr. M'Hardy.

Dawson B——, aged twenty-four, smith's helper, applied to me at the hospital on January 16, 1877. He stated that three days previously his right eye had been wounded by a small piece of metal. I observed that the iris was attached to the lens at the outer part of the pupil by recent lymph, and that there was a limited opacity of the lens. There was a small clear metallic body sticking at the margin of the adherent pupil. I made a small section of the cornea, more peripheral than the pupil, introduced a pair of iridectomy forceps, and seized the body and a little piece of iris; but the body slipped from my grasp, and was gliding out of my reach. Fortunately, I had anticipated such an untoward event, and took care to have a pointed permanent magnet at hand. I introduced it into the wound. The metal was instantly attracted and withdrawn. The patient continued under my observation till February 16. The opacity of the lens remained limited to the part wounded. I believe the wound in the capsule was closed by lymph and healed. I have not seen or heard from the patient since.

Moses E——, aged thirty-two, millwright, consulted me at the hospital on November 20, 1877. He stated that three quarters of an hour before his visit his right eye had been wounded by a chip of steel from a hammer. I observed a wound a little more than a line long in the ciliary region, just at the corneo-sclerotic junction. One end of the wound penetrated the anterior chamber, as shown by the evacuation of the aqueous humor and a slight displacement of iris toward wound. The wound was quite clean, and no foreign body was visible. Media clear. Ophthalmoscope did not disclose presence of foreign body. I put the point of the magnet cautiously into the wound, and at once it proved the presence of metal within the sclerotic by the click and the attraction. By a little patient and careful use of the magnet the metal was brought into the wound, and the end of it exposed so far as to enable me to seize it with forceps. Having caught it, I easily extracted it. The fragment was a thin piece about a line and a half long, one line in width at one end, half a line at the other end. The patient recovered completely, and returned to work on December 10 following.

There can hardly be a doubt that the magnet saved the eye in both cases. In the first case, to have followed the sharp fragment with forceps would probably have inflicted irreparable damage, and, indeed, the body might have got out of the way altogether. In the second case, the metal would probably, but for the magnet, have remained undetected, and have afterward lighted up destructive inflammation. Even had it been detected, it would not have been possible, but for the magnet, to have extracted it without enlarging the wound, and that is not desirable in any part of the eye, much less in the ciliary region. By the magnet the diagnosis was established, and the extraction effected in the most delicate way.—*Lancet.*

A New White Pigment.

Prof. Phipson, of London, in a paper read before the International Health Congress, at Paris, in August, remarked that for several years efforts had been made to discover some white substance to replace white lead for painting buildings, ships, etc. He himself had devoted several months to this important subject, but without success. There has been found, it is true, in oxide of zinc a substance less poisonous than lead, and serving very well as a white pigment in oil painting; but its production is very expensive, and its mechanical properties as a color in oil are not pronounced enough to allow it to compete in commerce with white lead. Such is not the case, however, with an invention of Mr. Thomas Griffiths, of Liverpool, who has succeeded in obtaining a very interesting product. This new preparation, which is being manufactured at the present time on a pretty extensive scale, has for its base sulphide of zinc (or an oxysulphide of that metal), the properties of which as an oil color are of the most remarkable character. It is prepared by precipitating one of the salts of zinc by a soluble sulphide, and washing and drying the precipitate. The latter is then calcined at a red heat, with some precautionary measures, then taken from the furnace, and, while still warm, thrown into cold water. It is afterwards levigated and dried. The result is a white pigment, very fine, and of great beauty. Regarded from a hygienic point of view, Griffiths' new white is infinitely superior to white lead, as it also is in its practical bearing; it possesses no injurious qualities; its manufacture and use do not affect the health of workmen; its durability in climates of the most diverse kinds is, so to speak, illimitable; it is altered neither by gaseous emanations nor by dampness; and its price is comparatively low. The most remarkable thing about this new white is that it covers much better than white lead, while it withstands the effects of all kinds of weather, so that its use is not only deprived of all danger to health, but it is much more economical than white lead. Prof. Phipson stated to the Congress that he regarded this new chemical preparation as being among the most ingenious and useful products that have been discovered in our time.

Direct Positive Process.

Herr Pillet produces, by means of this process, dark images upon a white ground, which may hereafter be strengthened or tinted by hand. The process rests upon the liability of chloride of iron to decompose in light when it is changed into the sub-chloride. The latter salt is not acted upon by a solution of red prussiate of potash, while the chloride at once becomes blue on treatment.

The paper on which the print is to be secured is prepared by dipping into a solution of water 30 grammes, chloride of iron 3 grammes, oxalic acid 1·5 gramme. The oxalic acid may be replaced by an equivalent of another similar organic acid. In the event of the paper not being properly sized, a little dextrine may be added to the bath. The paper is dried in the dark, and may be kept for an indefinite time without losing its sensitiveness.

In order to reproduce a design, sketch, or drawing of any kind, it is simply necessary to place the same upon a sheet of this sensitized paper, and cover the whole with a glass plate.

The printing is very rapid, for in summer only thirty seconds are necessary for exposure, and in winter from forty to seventy seconds in the sunshine. In shade, a much longer time is, however, required. From four to six minutes suffice in fair weather; but on a dark, dull day, sometimes forty minutes are necessary.

The electric light has been found to act very vigorously; the time of exposure depends upon the distance from the light, and the density of the original drawing or cliché.

After exposure the plate is dipped into a solution of water 500 grammes, red prussiate of potash 80 grammes. This colors all unchanged portions of the surface blue. The print is then washed in plenty of water and fixed in a solution of water 500 grammes, pure muriatic acid 50 grammes. Finally the print is washed and dried.—*Photographisches Wochenblatt.*

Cobalt in Electro-Metallurgy.

In studying some of the properties of magnetic metals obtained by means of galvanism, the attention of M. Gaiffe was attracted by the beauty of cobalt, and its hardness, which is much superior to that of iron and nickel; and the thought struck him that it might be possible to utilize this metal under certain circumstances, should it be found as easy to deposit it by the battery as it is the metals just mentioned.

It is well suited, for instance, to take the place of iron and nickel as a protective coating for plates used in copper-plate engraving. It does not oxidize like iron, and demands but little care for its preservation; it is dissolved with the greatest ease by weak acids which do not attack the copper, while nickel deposited on a copper plate cannot be renewed without injury to the latter. Its beautiful color will also cause it to be used for the decoration of other metals. The bath with which M. Gaiffe obtained very beautiful specimens was a neutral solution of double sulphate of cobalt and ammonia, which requires for its preparation scarcely as much care as baths of nickel. The anode may be a sheet of platinum, or, better yet, a plate of cobalt, either cast or forged. In this, cobalt differs from iron and nickel, which are soluble in thin baths only when they are in contact or combination with a body that is electro-negative with respect to them. In order to obtain a white, adherent deposit, the electric current should be regulated in the beginning at 6 volts, and should be reduced to 3 volts when the whole surface of the piece to be covered has become white. With a proper intensity of current, the deposit of cobalt takes place almost as rapidly as that of nickel. In four hours a layer of cobalt 0·025 millimeter thick may be obtained. When it is desired to obtain a very regular deposit, it is indispensable to fix the object to be "cobalted" to the electrode of the battery before immersing it in the bath. Without this precaution there would be produced an appearance of marbling, only removable by recommencing the process.

Journal Boxes for Steamers.

The advantages of a good lining metal for journal boxes and bearings have been clearly illustrated in the case of the ship Gleneagle, one of the tea clippers taking part in the annual race from China to London.

Last year this vessel lost the race by about one day and a half, and this was attributed to the bad working of her bearings, which were this year refitted and lined with Parson's white brass, and the crank pin brasses were replaced by manganese bronze.

The result of this alteration, we learn from a London paper, was that three more revolutions per minute were got out of the engine. The bearings ran without the slightest signs of heating, and the speed of the vessel was increased so that she made the passage in rather under two days less than she did last year, beating her former successful competitor by about one day.

Assuming the other vessel's speed to be about the same year as last the actual gain in the speed of the Gleneagle in the whole run from China, resulting from the adoption of the manganese bronze and the white brass, amounted to about two and a half days; the passage from Woosung to London, including detention at Singapore and the Suez Canal, having been accomplished in thirty-eight days two hours, said to be the quickest passage on record. On examination in London the bearings were found to be in the most perfect order, and so little worn that the vessel has been started on another outward voyage.

Wages in England.

The secretary of the Iron and Steel Association has received from a special correspondent in England the following particulars with regard to the wages paid there in April last:

WAGES PAID EMPLOYES ON THE MIDLAND RAILWAY—Enginemen, per day: first six months, 5s. 6d—\$1.34; second six months, 6s. 6d.—\$1.58; four years, 7s.—\$1.70; full pay, 7s. 6d.—\$1.83; permanent shunter, 6s.—\$1.46. Firemen, per day: first twelve months, 3s. 6d.—85c.; afterward, 4s.—97c.; passed as drivers, 4s. 6d.—\$1.10. Guards or brakemen, per week: passenger, main line, 21s. to 29s.—\$5.11 to \$7.06; passenger, branch line, 21s. to 25s.—\$5.11 to \$6.09; freight, main line, 24s. to 30s.—\$5.84 to \$7.30; freight, branch line, 24s. to 29s.—\$5.84 to \$7.06.

WAGES PAID EMPLOYES IN THE NORTH OF ENGLAND IRON MILLS—Puddling gray iron and mixtures, per ton, 8s. 3d.—\$2.01; prize money per week of full heats, 2s. 6d—61c.; prize money per shift to underhands for full heats, 6d.—12c. Heating rails, large mills, per ton, 1s. 4½d.—33c.; heating rails, small mills, per ton, 1s. 8½d.—42c.; reheating rails, large mills, per ton, 8¼d.—16c. Rolling rails, large mills, per ton, 1s. 9d.—42c.; rolling rails, small mills, per ton, 2s. 2½d.—54c. Laborers, mills and forges, per shift, 2s. 9¼d.—67c.; laborers, blast furnaces, per shift, 3s.—73c.

Labor in Belgium.

James R. Weaver, United States consul in Antwerp, Belgium, reports to the Department of State that labor is rarely performed in that country by the piece or job. The men oppose vigorously any attempt to change the present custom of work by the hour or by the day. They work 12 hours a day in summer and 10 in winter. They keep Sundays and numerous holidays, averaging only 22 working days in a month. The whole family works. Mothers leave their babies in the *creaches* (nurseries), where they are kept almost gratuitously, while the mother is at work with her older children. Since the extensive importation of American bacon, the poorer classes can indulge in meat as a small part of their food. The middle classes breakfast at six on pork, bread, butter and coffee; at ten o'clock they have bread, butter, and a glass of gin; at noon soup of meat and vegetables; at 4 P. M., bread, butter and coffee; in the evening, potatoes, buttermilk, broth, bread and butter, and occasionally tea. "Economical kitchens" have been successful in providing the poorer classes with good meals at small prices. The surplus earnings of the laborers too often go to the dramshops, When health fails, the father dies, and starvation threatens, the poor house is of easy access. The state, the church, and charitable institutions provide the means of existence or the cost of burial in such cases. None are permitted to beg. If too lazy to work they go to the workhouse; if sick or infirm, to the hospital or almshouse.

New Theory as to the Effects of Phylloxera.

M. Millardet, professor of botany at Bordeaux, has just communicated to the Academy of Sciences an entirely new theory in regard to the destructive action caused by the phylloxera.

According to him the rotting of the knots and tubers on the roots of the vines is to be attributed solely to the development in the tissues of certain fungi; and, in certain rare cases, to other parasitic organisms. Indeed, he asserts that he finds the mycelia belonging to various fungi of constant occurrence in the nodosities when they begin to decay. These same mycelia are also found in the body of the root itself, small or large, just as soon as it begins to rot. Their constant presence in the nodosities, tubers and body, even, of the roots affected by the malady, shows that they are intimately connected with the pathological state of the plant; they are the cause of the alteration of the roots, not the effect of it. They do not spread through the latter because they are rotten, but they at once determine such rotting by their development. Indeed, we always detect them at the origin of the trouble, that is to say, in the very smallest decaying spots; and in such cases even in the midst of apparently healthy tissue.

Rails.

The writer of a paper recently read before the British Iron and Steel Association estimates that 30,204,000 tons of iron rails have been laid down during the past ten years, and that the quantity annually required for repairs is 3,020,400 tons; for new lines, etc., 1,090,000 tons; a total of 4,110,400 tons. He also estimates the annual production of rails at 2,745,000 tons, 879,000 of which are turned out in the United States. This shows a current deficiency of production to meet the proper demand of 1,365,000 tons. That orders for this amount have not been given is attributed to the economy or necessity which has forced railroad companies to postpone repairs as long as possible, and in some measure to the substitution of steel rails, which have a longer life.

IN an experiment recently made in Bombay, India, to determine the power of solar heat for governing steam, nine gallons of water were put in a small boiler, and boiled by the rays of the sun in exactly thirty minutes. After boiling one hour the focus was turned off, when it was found that 3¾ gallons had been evaporated. In the experiment 198 glass mirrors, each 15 inches by 9½, were used.

THE PORCUPINE ANT EATERS RECENTLY DISCOVERED IN NEW GUINEA.

Every one has perhaps heard of the duck mole (*Ornithorhyncus*) and the porcupine ant eater (*Echidna*), the most singular of all marsupial mammals—a class of animals confined exclusively to Australia and the adjacent islands. These animals were known to neither Buffon nor Linnæus, specimens having been brought to Europe for the first time at the close of the eighteenth century by Sir Joseph Banks, one of the companions of Capt. Cook. Peron and Lesueur, who made a voyage similar to that of Banks, on a French vessel commanded by Bandin, also procured specimens. Professor Blumenbach, of Hanover, having received a duck mole for examination, proposed for it the generic name that it still retains—*Ornithorhyncus*—and he named the species (the only one thus far known) *Ornithorhyncus paradoxus*, which at once recalls the form of its bill (like that of a duck) and the oddness of its principal characters. Almost at the same time the English geologist Shaw proposed the name *Platypus anatinus*, the generic name having reference to the palmate or webbed feet of the animal, and the specific name expressing the resemblance of its bill to that of the duck. Since that time the numerous memoirs that have been written on the subject of the ornithorhyncus have had more especial bearing on the curious and important characteristics by which mammals of this sort are distinguished, and which make it one of the most inferior animals of the class of marsupials.

This inferiority is seen in the conformation of the skeleton, the disposition of the reproductive organs, and in several other systems of organs, as well as in the structure of the offspring.

The porcupine ant eaters (*Echidnæ*), of which it is our intention to speak more particularly in this article, partake of this same inferiority; it is for this reason that these two genera have been brought together to form a sub-class by themselves, known as *Monotremes*, which seems to form a connecting link between mammals and birds, and in some respects having anatomical affinities even with reptiles.

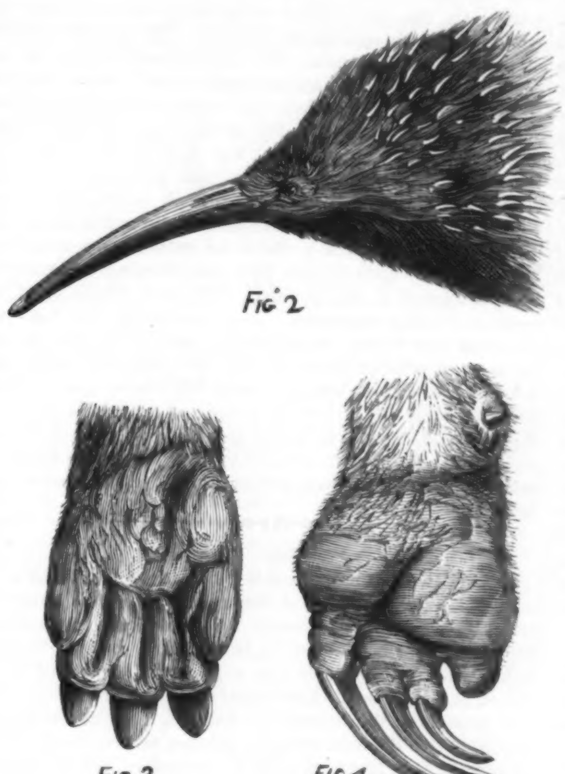
The porcupine ant eaters (of which several species are known) are not, like the duck mole, aquatic in their habits, so their feet are not webbed, but are furnished with five well developed toes with large nails, the forefeet being formed for burrowing, and the hind feet in the male armed with a horny spur, as in the duck mole (Figs. 3 and 4). Their snout, although horny, and in many respects analogous to that of a bird, is not flattened like the bill of a duck, but long and slender (See Figs. 1 and 2). Their tongue is very long, slender, and protractile, as in the ant eaters properly so-called. The upper part of the body is covered with spines and hairs intermixed, like those of certain species of hedge hogs and porcupines.

Shaw, who first described the Australian echidna, saw no possibility of separating it generically from the ant eaters proper, so classed it under the same generic name. It was Cuvier who demonstrated that it should be separated and placed in a genus apart, and it was he who erected the genus *Echidna* to receive it. The learned German naturalist, Illiger, has substituted *Tachyglossus* for the Cuvierian nomenclature, this name (from Greek, *tachus*, swift, and *glossa*, tongue) having reference to the swift movements of the tongue of the animal in seizing its prey.

The porcupine ant eaters inhabit sandy places, and scratch up the earth to find their food; this consists of ants and other small insects, which it captures like the ant eaters with its tongue, by means of a viscid matter secreted by two large submaxillary glands extending from behind the ear to the forepart of the chest; there are no teeth in the jaw, but the palate is armed with several rows of horny spines directed backward, and the upper surface of the tongue is furnished with numerous small horny warts. In captivity it is a slow-moving, stupid animal, avoiding light, and displaying activity only in burrowing, which it does with amazing rapidity. When irritated it rolls itself up into a ball, its head between its forelegs. It can sink into the loose sand directly downward, presenting only its spiny back to its enemies; yet, in spite of its defensive armor, it often falls a prey to carnivorous marsupials. Until to within comparatively few years, but a single species was known—the Australian *Echidna aculeata* (Shaw); but it has now been found that Australia is not the only home of these singular animals. Two species have also been found in New Guinea, that country which has so many analogies with Australia proper, in respect to its principal productions and mammalian fauna. These two species are quite different from that just mentioned; one of them, Lawes' echidna (*Echidna Lawesii*), being more closely related to the Australian animal than the other, which has been named Bruijn's echidna (*Echidna Bruijnii*). These two animals are so different from each other that there would be no danger of referring them to the same genus. While the first-mentioned has, like the Australian animal, a beak of medium length, and five-toed feet provided with nails, the second has an exceedingly long beak, comparable with that of the New Zealand bird, the apteryx; besides, it has only three clawed toes to each foot, and, moreover, its tongue is remarkable for the three rows of horny hooks directed backward, and situated at its base. These remarkable characteristics have led M. Gervais to erect a new genus—*Acanthoglossus*—to receive such animals as Bruijn's echidna; and a full discussion of the facts relating to the question will be found in a quarto memoir, entitled "Osteography of the Monotremata," by this author, published a few months since at Paris.

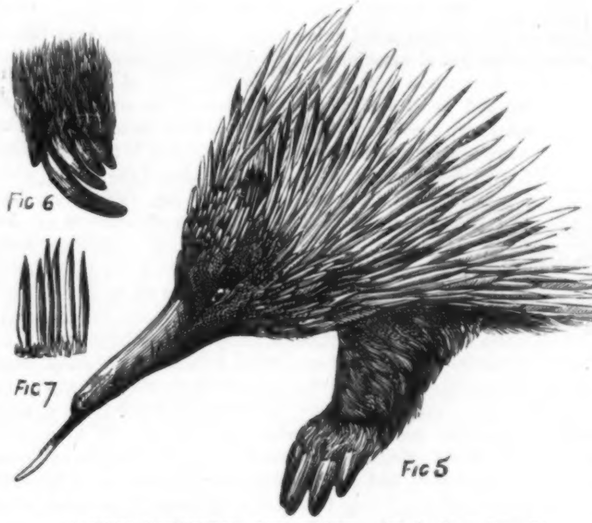
In conclusion, it should be stated the Lawes echidna was discovered at Port Moresby, in that part of New Zealand which is nearest to Australia, and that Bruijn's echidna was found at Mt. Karon, in the northern part of the same archipelago. The figures which illustrate this article refer solely to these two new species.

The common name—porcupine ant eater—which has been bestowed on these animals is far from being appropriate, since they are neither rodents like the porcupine nor edentates proper like the ant eater, though they have the spiny covering of the former, and the toothless jaws of the other. Still, this name, originally imposed by Shaw, may be the best that could have been selected to denote such odd animals.



BRUIJN'S PORCUPINE ANT EATER

Fig. 2.—Head and Beak; Fig. 3.—Forefoot of Male; Fig. 4.—Hind Foot of Male



LAWES' PORCUPINE ANT EATER.—(*Tachyglossus Lawesii.*)

Figs. 5, 6, and 7.—Head, Beak, and Forefoot; Foot detached, and a few Spines of the Animal.

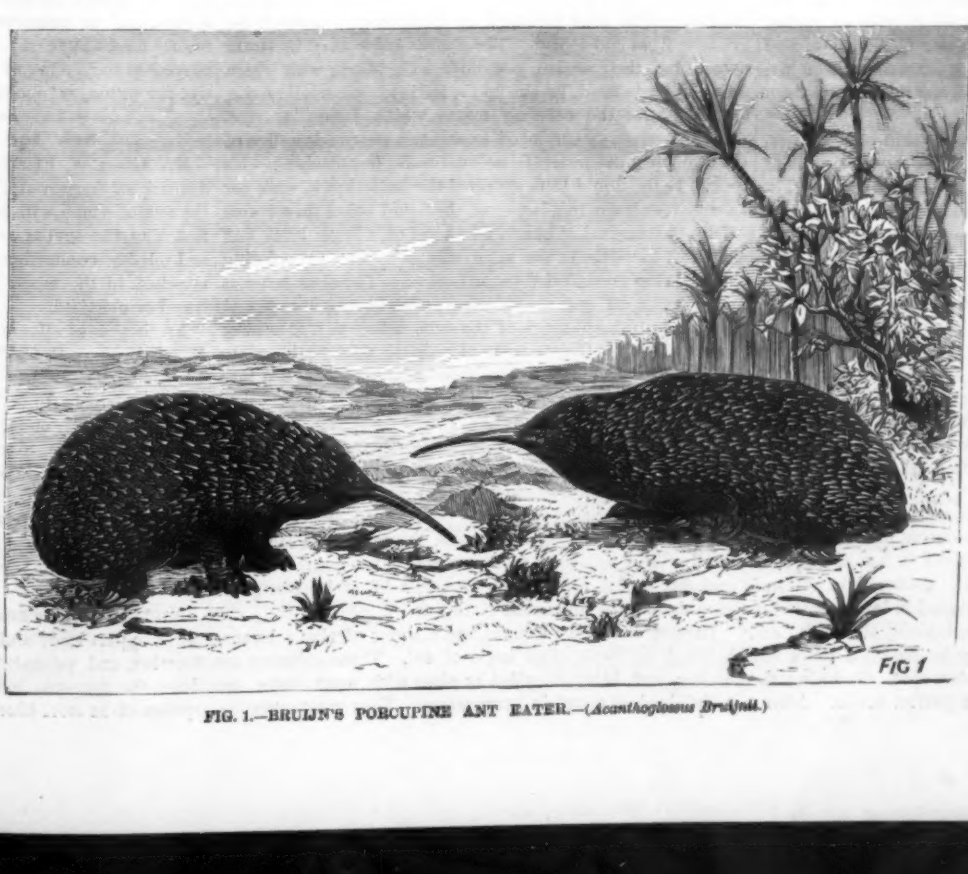


FIG. 1.—BRUIJN'S PORCUPINE ANT EATER.—(*Acanthoglossus Bruijnii.*)

Hair Eels.

In many parts of the country the notion has long prevailed that if horse hairs be placed in a brook and left there, they will after a time become endowed with life; in short, that they will turn into hair eels. Very recently, a correspondence on this subject was published in the columns of a prominent Scotch newspaper, between an anonymous writer and Dr. Andrew Wilson, of the Edinburgh School of Medicine; the former alleging that a friend in Shetland had succeeded in effecting the transformation of hairs into "hair eels," the latter denying that any such "spontaneous generation" of living beings was possible. The life history of the *Gordius aquaticus*, as naturalists name the hair eel, is perfectly well known. It passes the earlier stages of its existence as a parasite, lying coiled up within the body of an insect, such as the grasshopper; the worm exceeding its host many times in length. In this condition it is immature, and has no power of reproducing its kind. When mature, it leaves the body of the insect and seeks the water, being found in summer at the breeding season in thousands in some localities. There the eggs are laid in long strings, and from each is developed a tiny embryo or young gordius, which gains admittance to an insect host, there to lie quiescent for a time, and soon to repeat the history of its parent.

It is plain that in such a life history there is neither room nor need for the supposition that hair eels are developed in an unnatural fashion, and at the will of man. The fallacy that hair eels are transformed hairs arises frequently from imperfect observation; often from preconceived notions, and from an inability to perceive the unnatural nature of the supposition, or to reason out the procedure adopted to produce the hair eels. Thus, for instance, it would be an absurd supposition were any one to maintain that hair eels could only be formed artificially from hairs. It is a perfectly evident truth and a demonstrable fact that they reproduce their kind by means of eggs, and this fact shows us that they possess a natural method of reproduction, and further that the statement of any supposed infringement of a natural law should be received with caution and suspicion.

But judging the "hair eel" tales on their own merits, is the evidence of the experimenters trustworthy as to their facts? And even admitting that the facts are as they have been stated, it may be asked if a more rational interpretation of them cannot be given. A boy places a number of horse hairs under a stone in a brook. Three weeks afterward he finds the brook to be swarming with hair eels; therefore, he concludes that his hairs have become transformed into hair eels. But the old maxim, *Post hoc non propter hoc*, must be borne in mind. It does not follow, as a matter either of logic or common sense, that because hair eels are found in a brook where horse hairs were placed three weeks or so previously, the transformation of the hairs into living worms is proved. Could any experimen-

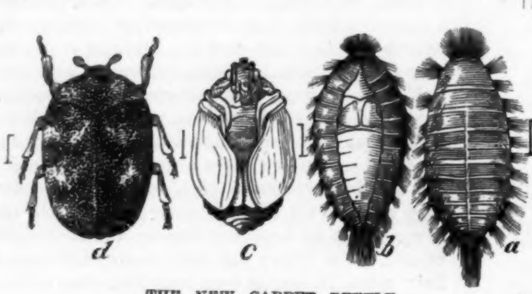
ter, for instance, be prepared to state that he had found in the brook just as many hair eels as there were horse hairs? The brooks literally swarm with hair eels in summer, and, as already remarked, the upholders of the "horse hair theory" will have not merely to account for the transformation of hairs into hair eels, but also for the marvelous multiplication of the former.

Then, also, we must not lose sight of the simple and natural explanation that hair eels occur after experimentation, simply because they appear naturally in the brook at their own breeding season. Why are hair eels not obtained in winter from horse hairs? The answer is clear. Because in winter these animals are encysted, or exist as do many other co-tenants of the brook, in a torpid state, and because the breeding season is past and over. Best of all, it must be remembered that against the precise information of the naturalist there is no evidence forthcoming of the steps of this marvelous transformation. The idea that horse hairs contain potentially in themselves generations of living beings simply exemplifies a use of the imagination the reverse of scientific, and offers a fresh proof that the superstitious habit of preferring an unnatural to a natural explanation of common phenomena is not yet extinct in this advanced and enlightened age. The exponents of the "horse hair" theory in truth hardly realize the exact nature of their belief—that a dead structure should give origin to a living animal—otherwise they would be chary of asserting that every country boy is able to perform a veritable miracle and act of creation—the mere idea of which, as an act of human power, has never entered into the mind of any scientist, save in the dark ages of myth and superstition. We must not be deemed uncharitable if we venture to regard the hair eel myth as a survival of a bygone age, when the fabulous in zoology represented the exact science of to-day.—*Chambers' Journal.*

THE NEW CARPET BEETLE.

In vol. xxxv. of the SCIENTIFIC AMERICAN we noted the recent advent into this country of a new carpet beetle, which had been brought to the notice of the scientific world by Mr. J. A. Lintner, the entomologist of New York State. This beetle, new to every one, was pronounced by Dr. Le Conte to be a European species, the *Anthrenus scrophulariæ*, and closely allied to the museum pest (*A. varius*). Its habitat was stated to be beneath the borders of carpets where nailed to the floor, eating in those portions numerous holes of an inch or more in diameter

Occasionally it made its way into the crevices left by the joinings of the floor, following which, entire breadths of carpet would be cut across as if by scissors. In several instances carpets had been destroyed—new ones as readily as older—and it was questioned whether their use could be continued in view of the prospective increase of the alarming ravages. Since the period of its discovery, in 1874, up to the present time, this destructive insect has gradually spread over the country until it has been heard of from several States. From the advance sheets of the Thirteenth Annual Report on the New York State Museum, we obtain the accompanying figures of the beetle in its various stages, drawn by the skillful pencil of Professor C. V. Riley; and also a further description of the insect from the pen of Mr. Lintner. The figures are all enlarged, the lines beside them giving the natural size of the insect.



THE NEW CARPET BEETLE.

a, Larva; *b*, Skin of Larva; *c*, Pupa; *d*, Perfect Beetle.

At *a* is represented the larva; at *b*, the skin of the latter, after the beetle has emerged from the fissure on the back; at *c*, the pupa; and at *d*, the imago or perfect beetle. The larva (*c*)—the form in which it is usually found when pursuing its ravages beneath the carpets—measures, at maturity, about 3-16 of an inch in length. A number of hairs radiate from its last segment, forming a tail-like pencil nearly as long as the body; these are not shown in their full length in the figure, the latter having perhaps been drawn from an immature specimen. Similar short hairs clothe the body, those on the sides forming tufts. The body appears to be banded in two shades of brown, the darker band being the central portion of each ring, and the lighter the connecting portion of the rings. On the underside will be found the six little legs, of which it makes such good use in extending its field of depredation.

After attaining its full growth, it makes preparation for its pupal change. It constructs no cocoon, but merely seeks a quiet retreat, where it remains until it has nearly completed its pupation, being the while unaltered in external appearance, except somewhat contracted in length. Its pupation completed, the skin is rent along the back, and through the fissure the pupa may be seen. After a few weeks the skin of the pupa is also split, disclosing the brightly colored wing cases of the perfect beetle. After a few days' repose the fully developed insect emerges from the pupal case and appears in its final stage.

The beetle is quite small (about ⅛ of an inch long by 1-12 broad), elliptical in form, and rounded above and beneath. It is beautifully marked, its colors being black, white, and scarlet. The edges of the wing cases, where they meet, is bordered with scarlet forming a central red line, with three red projections from it outward. The first projection, near the head, is connected with a white spot running upward. On the outer border of the wing cases are three white spots nearly opposite the red ones. The ground color of the wing cases is black. The earliest beetles emerge in October, and continue to appear during the fall, winter, and spring months. They probably pair soon after their appearance, and the females then deposit their eggs for another brood of the destructive larvæ. The latter do not confine themselves entirely to carpets, but also infest articles of clothing in closets or drawers. Through correspondence with European entomologists, Mr. Lintner discovered the remarkable fact that this beetle in its native home is not known to prey upon carpets (this taste seemingly having been developed in this country), but there infests dried meats and similar substances. As to the remedy, Mr. Lintner states that Persian insect powder, camphor, pepper, tobacco, turpentine, carbolic acid, etc., are powerless; but he believes that cotton, saturated with benzine or kerosene, stuffed into the joinings of the floors and crevices beneath the baseboards during the winter months would prove fatal, since at this season the insect will be found occupying these retreats, either in its perfect form or as eggs for another brood.

Lac.

Lac, in its raw condition, is, as is well known, found in India incrusted round the twigs of the trees in which the insect feeds. The twigs are generally, for convenience of transport, brought to market cut up in lengths of two or three inches, and it is probable that a great deal of material is wasted in this process. The objects of the manufacture are, first, to separate the resinous incrustation from the wood; second, to free the resin from the coloring matter; third, to convert the resin into what is known as shellac; and, fourth, to form from the coloring matter cakes of dye, known as lac dye. As generally practiced, these processes are conducted in a primitive manner. Mr. O'Connor, from whose notice upon the Indian lac in all its branches the following particulars are taken, was enabled to see the extensive lac factory belonging to Mr. Elliott Angelo, of Cossipore. The manufacture is there conducted on an improved and civilized system by the aid of machinery worked by steam power. The lac is first separated from the twigs by the action of rollers, worked by steam. Of these rollers there are three sets, each consisting of an upper and an under roller with a sieve attached. Between these the twigs pass from a feeder, and the lac is, by the turn of the roller, separated from the wood and broken up, falling on to a sieve, while the twigs are thrown off aside in a heap. If the lac has not been sufficiently broken up by the first roller to pass through the sieve, some of the twigs not having been separated, it passes on to the second roller, and goes through the same process, passing again if still not fine enough, to the third, whence the lac is dropped, as the sieve is filled, into a series of small troughs arranged in an endless chain working with the machine, and is projected thence, as the chain moves, into a heap upon the floor. The twigs are thrown off to a platform on the other side. These are afterward again examined by women, and all the remaining lac separated by hand, and as far as it may be worth while used in manufacture. The refuse is bought by natives for the manufacture of various articles made of lac. The sticks are used for fuel in the furnace of the steam engine.

The lac is now placed in a horizontal cylinder furnished internally with arms arranged on a bar passing through the cylinder from end to end. These arms are worked by steam power, and their action, combined with water, with which the cylinder is filled, breaks up the lac into very small pieces, and separates the coloring matter which forms lac dye. Lime is frequently employed to assist in the precipitation of the dye when the water is not naturally impregnated with lime. In the liquid thus obtained the lac is left to soak for twenty-four hours in a large vat, the liquid being then drawn off, by the removal of plugs, into a vat on a lower level, and there left to settle in the same way as indigo, the coloring matter being precipitated to the bottom. The clear water at top is drawn off, and the sediment, after having been passed through a strainer—much of the same nature as that used by papermakers for the straining of pulp—is finally allowed to settle and consolidate, when it is pressed in frames into cakes, which are afterward dried in the sun. These cakes are the lac dye of commerce.

The lac, now called "seed lac," after maceration, is thoroughly melted in a close vessel heated by steam, and thence conducted into open shallow troughs, also heated by steam, where the melting continues. Some resin is here mixed with the lac, to act as a flux and to prevent the lac from burning and adhering to the vessel. The resin, which is probably useful for this purpose, flies off, at least in great part, during the process of ebullition.

Ranged round the troughs are a series of zinc columns, inclined outward at an angle of 45°. These columns are hollow, and, being supplied by pipes with tepid water, are maintained at a certain temperature. They must never become too hot, or the fluid lac would not consolidate; nor must they become too cool, for then the lac would harden at once, and break up into small fragments, which would adhere to the surface of the column. A quantity of the melted lac is now taken up by a workman in the concavity of a piece of plantain bark—this being the material best adapted to the purpose—and flung on to one of the columns. Here the liquid mass is spread evenly and thinly over the surface by a man, who makes use, for the purpose, of a leaf of the pineapple plant, or some other tough, fibrous material. The leaf being held in both hands, its edge is drawn over the material until the mass is properly spread over the surface of the column to the required degree of fineness. It begins to consolidate at once, and becomes of a pliable, leathery texture. As soon as the lac is thoroughly consolidated it is taken off by a workman while still so hot that it would burn the fingers of any person not accustomed to the work, a considerable section of the upper portion of the sheet of lac being torn off, because it is thicker there than in the rest of the sheet, and thrown back into the trough to be melted again. The sheet is placed on a rod held in readiness by a woman, each extremity of the sheet hanging down, like a towel on a rack, and the whole is hung up to dry in a large drying shed, the rods supporting the lac being ranged on supports running across the sheds from side to side, just like a tobacco drying house. The next day it is fit for dispatch, and it is then packed in boxes and sent away. The various qualities of shellac are known by different names and marks, and there is a considerable range in prices, from "Fine Orange DC" to "Livery," "Garnet," "Native Leaf," and "Button." The last quality is so named from the lac not being made in sheets, but dropped from a height and solidifying into masses.

In India lac is used chiefly for the manufacture of bracelets, rings, beads, and other trinkets, worn as ornaments by women of the poorer classes. The lac is bought in the bazaar, and, after having been melted, it is mixed with vermilion, arsenic, and lampblack for coloring purposes. It is also used as a varnish, in many cases the dye being left in the lac to produce a colored varnish; by the turners of wooden toys, which are coated neatly with colored compositions, in which lac predominates; in lacquered ware, and by goldsmiths for the coloring of the metal. In Burmah it is also employed to fix the blades of knives, and similar instruments, in their handles. In Bombay Presidency and elsewhere lac is also used in manufacturing grindstones, for which purpose three parts of river sand and one part of clean seed lac are mixed over a fire, the mass being formed into the shape of a grindstone, having a square hole in the center. This is then cemented to the axis with melted lac, and the stone, having been moderately heated, is caused to revolve rapidly, when it can easily be turned down to shape. The sand should be finer and the proportion of lac greater when the stone is only required for polishing. Japanese lacquered ware is made of an entirely different material, being a varnish obtained from the gum exuding from certain trees.

In Europe, lac is largely used in the preparation of varnishes and by hatters. The body of all the silk hats in common use is rendered stiff and waterproof by the liberal application of a composition of shellac, sandarac, mastic, and other resins, dissolved in alcohol or naphtha. The brim is always imbued more thickly than the body with this varnish.

Lac is also extensively used in the manufacture of sealingwax, which is formed of an amalgam of shellac, Venice turpentine, colophony, and coloring matter, the quantity of lac used being equal to that of all the other articles put together. Lac also enters largely into the composition of lithographic ink, and in the preparation of lake (the name is derived from "lac"). Lake, however, is also made with madder and cochineal. Lacquer is based on a solution of shellac in alcohol, colored with gamboge, saffron, etc. It is used to give a golden color to brass and other metals, and to preserve their luster. In India, lac dye is mostly used to dye silk, and to some extent it is also employed in the dyeing of leather. It is not much used as a dye for cotton, on account of the expense.

New Agricultural Inventions.

Mr. Albert W. Flanders, of North Grantham, N. H., has devised an improved Fastening for fastening a Scythe to the Snath, which will not require the use of a wrench in fastening the scythe or removing it, and will make a firm and reliable connection. It is of such form that it may be attached to the snath without requiring the snath to be bored or mortised.

An improved Horse Hay Rake has been patented by Messrs. William P. Clark and Charles E. Clark, of Belmont, N. Y. This horse hay rake is so constructed that the teeth may be raised to drop the collected hay by the revolution of the drive wheels, or by the driver with a hand lever.

Mr. Manfred D. Slocum, of Union City, Mich., has patented an improved Jointer Clamp, by which the jointer may be readily adjusted to bring it into line with the plow when the plow beam is adjusted to cause the plow to take or leave land, and which permits the jointer to be adjusted to bring its colter toward or from the land, as desired.

NIELLO.—This consists of nine parts silver, one part copper, one part lead, and one part bismuth, which are melted together, and saturated with sulphur. This mixture produces the gorgeous blue which has often been erroneously spoken of as steel blue.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

W. H. S.—You can obtain "Allen's Artificer's Assistant" from Allen & Co., Publishers, 33 Murray St., this city price $2.50. See condensed table of contents in last week's paper, page 205.

Vertical Engines, 10 to 15 H. P., thoroughly well made. John Hartrick & Co., 47 Gold street, New York.

H. W. Johns' Asbestos Liquid Paints are the purest, most beautiful and durable paints in use. They are also more economical than the best white lead and oil, and are adopted by the most extensive users of paints in this country.

80 lb. dead stroke Power Hammer, in good order, for $175; regular price $750. Apply to T. Shaw, Mercury Gauge Warerooms, 915 Ridge Ave., Philadelphia, Pa.

Try Penfield Tackle Block Works, Lockport, N. Y.

Water Wheels, increased power. O.J.Bollinger,York,Pa.

Who wants to make and introduce patented Sheaf Binder of sheet iron and wire—excels all—or buy rights? A rare opening. See SCI. AM. Sep. 21, 1878. Address J. Bannihr, 277 E. 10th St., N. Y.

For the most substantial Wood-Working Tools, address E. & T. Gleason, 52 Canal St., Philadelphia, Pa.

Bevel Protractor.—Patent for sale. Combines several drawing tools. F. L. Cook, Fairfield, Iowa.

Sugar House Machinery for Plantations. Manufacturers please send illustrated circulars and price lists to Box 315, Natick, Mass.

Wheelbarrows.—Over 50 styles, with felloe-plated, bolted wheels. Pugsley & Chapman, 8 Liberty St., N.Y.

Notice.—Charles N. Elliott, of N. Y., is no longer connected officially with the Ingersoll Rock Drill Company, and is not authorized to collect moneys or transact any business whatever for the same. By order of H. C. Sergeant, President; F. M. Pierce, President *pro tem.*

Wanted.—1,200 feet of side track (36 lbs. to the yard), second quality or good second hand railroad iron. Address Bodwell Granite Company, Vinalhaven, Me.

For Sale.—One set Eccentric or Die Rolls. Henry Disston & Sons, Philadelphia, Pa.

Exhibition Magic Lantern and 60 Views, only $25. Catalogue free. Outfits wanted. Theo. J. Harback, Importer and Manufacturer, 809 Filbert St., Phila., Pa.

The improved Gatling Guns fire over 1,000 shots per minute, and are the most destructive war weapons ever invented. Gatling Gun Co., Hartford, Conn., U.S.A.

For Town and Village use, comb'd Hand Fire Engine & Hose Carriage, $350. Forsaith & Co., Manchester, N. H.

Blowers.—One No. 5, two No. 6, regular pattern, steel, pressure Sturtevants; one No. 6, Hot Blast Apparatus; also other sizes for sale very low. Exeter Machine Works, 140 Congress St., Boston, Mass.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Use the Patent Improved Sheet Iron Roofing and Drip Crimped Siding made by A. Northrup & Co., Pittsburg, Pa. Send for circular and prices.

The well known Asbestos Roofing has a larger sale than all other kinds of portable roofing combined.

Engine Builders' Brass Goods, Oil Feeders, Glass Oil Cups, Shaft Cups. All goods strictly first class. Address Cincinnati Brass Works.

Nickel Plating.—A white deposit guaranteed by using our material. Condit,Hanson & Van Winkle,Newark,N.J. English Agency, 18 Caroline St., Birmingham,

J. C. Hoadley, Consulting Engineer and Mechanical and Scientific Expert, Lawrence, Mass.

Boilers ready for shipment, new and 2d hand. For a good boiler, send to Hilles & Jones, Wilmington, Del.

Punching Presses, Drop Hammers, and Dies for working Metals, etc. The Stiles & Parker Press Co., Middletown, Conn.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

1,000 2d hand machines for sale. Send stamp for descriptive price list. Forsaith & Co., Manchester, N. H.

Presses, Dies, and Tools for working Sheet Metals, etc. Fruit and other Can Tools. Bliss & Williams, Brooklyn, N. Y., and Paris Exposition, 1878.

Pulverizing Mills for all hard substance and grinding purposes. Walker Bros. & Co., 23d and Wood St., Phila.

The Cameron Steam Pump mounted in Phosphor Bronze is an indestructible machine. See advertisement.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Best Wood Cutting Machinery, of the latest improved kinds, eminently superior, manufactured by Bentel, Margedant & Co., Hamilton, Ohio, at lowest prices.

We make steel castings from ¼ to 10,000 lbs. weight, 3 times as strong as cast iron. 12,000 Crank Shafts of this steel now running and proved superior to wrought iron. Circulars and price list free. Address Chester Steel

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

Blake's Belt Studs are the strongest fastening for Rubber or Leather Belts Greene, Tweed & Co., 18 Park Place, N. Y.

Solid Walrus Wheels. Wood Wheels Covered. Fine Wool Felt Wheels for Polishing. Greene, Tweed & Co.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in Scientific American of last week.

Extra Fine Taps and Dies for Jewelers, Dentists, and Machinists; in cases. Pratt & Whitney Co., Manufacturers, Hartford, Ct.

The genuine Asbestos Coverings for Steam Pipes and Boilers are manufactured only by the H. W. Johns Manufacturing Company.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa

Machine Cut Brass Gear Wheels for Models, etc. (new list). Models, experimental work, and machine work generally. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N.Y., U.S.A.

Manufacturers of Improved Goods who desire to build up a lucrative foreign trade, will do well to insert a well displayed advertisement in the SCIENTIFIC AMERICAN Export Edition. This paper has a very large foreign circulation.

The Turbine Wheel made by Risdon & Co., Mt. Holly, N.J., gave the best results at Centennial test.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new Injector, worked by a single motion of a lever.

Address Star Tool Co., Providence, R. I., for Screw Cutting Engine Lathes of 13, 15, 18, and 21 in. swing.

Dead Pulleys, that stop the running of Loose Pulleys and Belts, taking the strain from Line Shaft when Machine is not in use. Taper Sleeve Pulley Works, Erie, Pa.

Notes & Queries

(1) J. W. R. asks: What figure will be generated by the oblique section of a cylinder by a plane passing through both sides of the former? A friend of mine maintains that it will be an ellipse, which I think is purely a conic section, and is generated by the section of a cone by a plane passing through both sides of it at a greater or lesser angle with the bars. I do not find a satisfactory statement in the books. A. We are inclined to agree with your friend.

(2) H. & H. ask: What is the speed of a tornado and a hurricane? A. A tornado and a hurricane are the same. The speed of the wind in a tornado is 90 to 100 feet per second.

(3) G. A. D. asks where to obtain a cartridge that makes no report when fired. A. Such a cartridge cannot be made.

(4) B. K. B.—See answer to H. T., p. 155, last number of the SCIENTIFIC AMERICAN. The metals cannot be silver plated in the way you suggest.

(5) H. H. D. writes: I read in your paper several years ago about sawing wood with a piece of wire and electricity. Do you know whether it was a success or not? A. We do not think wood sawing can be economically done in the way mentioned. We are not aware that there is any patent on it.

(6) C. J. C. writes: In the issue of August 24, in answer to query C. J. C., you simply answer, "24 lbs." If I am not asking too much, will you please explain why it is as you say? A. The spring being under a strain of 24 lbs. pulls equally in both directions. If the spring balance were hanging from a fixed support with a 24 lb. weight attached, the downward pull on the support would be 24 lbs. + the weight of the scales. If you substitute one hand for the weight and the other for the fixed support, the result will be obvious. And if you place the scales in a horizontal position the result would be the same, leaving out of consideration the weight of the scales.

(7) J. W. B. asks whether a motive power can be produced without heat that will drive an engine (about 1 horse power) either by the use of chemicals or compressed air and chemicals. If so, what is the process? A. You can use a spring, compressed air, or electricity. For addresses of manufacturers, you should insert a notice in the "Business and Personal" column.

(8) H. G. W. writes: It has frequently been remarked that the instinct of the lower animals is quite liable to mistakes. I noticed lately something of this nature so singular that I send you an account of it. While engaged reading in my sitting room, I saw by a glance from my paper a butterfly—the Vanessa atalanta—settle upon the front door post, remaining quiet, excepting a slight but continuous vibration of the wings. Soon there appeared a humming bird, which, remaining poised in air, repeatedly thrust its bill between the insect's wings. After retaining position for several moments, the butterfly moved about, attended by the humming bird, until the latter, evidently disgusted with the traveling tendencies of the seeming blossom, flew away. A. Since the humming bird is an eater of small insects it is more probable (the observation being correct) that the bird mentioned above was in search of parasites upon the butterfly, than that it mistook the insect for a flower.—ED.

(9) N. T. E. asks: Can a band saw running on three foot pulleys be run with half the width belt of a saw running on six foot pulleys, both using the same amount of power and traveling the same number of feet per minute with the same size of driving pulleys? A. No, as we understand your meaning.

(10) K. L. D. asks how to make the so-called chloride of nitrogen with as little danger as may be to life and property. A. The following is perhaps the safest method of preparing the mixture in small quantities: A somewhat dilute and tepid (not hot) solution of ammonium chloride (sal ammoniac) in distilled water is poured into a clean porcelain dish, and a bottle of chlorine, the neck of which is quite free from grease, inverted into it. A clean shallow and heavy leaden cup is placed beneath the mouth of the bottle to collect the product. When enough of the oily nitrogen chloride has been obtained, the leaden vessel may be carefully withdrawn, with its dangerous contents covered with a stratum of the ammonium chloride solution. Contact with combustible organic matter of any kind determines its immediate explosion, so that the vessels employed must be scrupulously clean.

(11) W. N. F. writes: The statement is often made that a locomotive can start no load greater than its own weight. How important an element in the power of a locomotive is its own weight? A. The weight of the engine prevents the slipping of the driving wheels, or permits the exertion of tractive force; the statement in regard to starting is not generally true.

(12) E. B. asks: Can air be brought to a freezing point by setting it in motion? Are there any works on scientific ice making or air cooling? A. By condensation and rarefaction, yes; not otherwise, as we understand you. When air is condensed by pressure, part of its latent heat becomes sensible heat; and if the condensed air is allowed to stand until it regains its former or normal temperature, and is then released, it will be found as much colder than the surrounding air as it was hotter the moment after compression. The cooling of the condensed air may be facilitated by bringing it, or the vessel containing it, into contact with cold running water. You will find the principal ice making machinery and processes described and illustrated in Knight's "New Mechanical Dictionary." See also pp. 95, 335, and 168, vol. 37, and 159 and 397, vol. 38, of the SCIENTIFIC AMERICAN.

(13) G. W. F. asks: What advantages has the oscillating engine over the ordinary crosshead engine, and why is it not more used? A. The advantages claimed for oscillating engines are compactness and decrease of weight. There are many engineers who consider the trunnion packing and necessary methods of support objectionable.

(14) J. F. McC. asks: 1. Do all manufacturers of articles which have a taper head, such as wood screws, etc., make the same taper or angle? If they do what is the angle? A. The angle of 90° is generally used. 2. Is there a standard angle or taper for lathe centers (both ends)? If so, what is it? A. 60°.

(15) H. S. asks how to make sulphurous acid (SO_2), and how to liquefy it on a small scale. A. Place 1 oz. of clean copper wire or turnings and 4 or 5 ozs. of concentrated sulphuric acid in a glass retort which it will about half fill, and carefully heat the contents until the gas begins to pass over. The gas may be liquefied by passing it through a perfectly dry stout glass U tube, surrounded by a mixture of pounded ice and salt, 2 of ice and 1 of salt. If the upper ends of the U tube are provided with stop cocks (or hermetically sealed with the blowpipe) the contents of the tube may be retained in the liquid form when the tube is removed from the refrigerant. The gas should be passed through tubes containing sodium sulphate and calcium chloride to free it from impurities and moisture before entering the condenser.

(16) L. writes: A Lockridge air brake is operated by an eccentric on engine driving axle. The air pump is 7 inches diameter and about 5½ inches stroke. The engine with 5 foot driving wheels has to average 30 miles per hour. The air pump piston is packed with a sole leather cup which gets very dry and hard in a run of 50 miles, so much so as to be useless. Can you tell me of any process by which the leather can be made to do better? A. We think that if you will lubricate the cylinder you will have no further trouble.

(17) C. P. K. writes: I made a telephone as described in No. 5, vol. 39, but although I followed directions very carefully it will not work; so I want to know what kind and thickness of cord or thread to use, and what is the greatest number of turns or angles in the thread which will not interfere seriously with its conducting power. I had to make 16 turns to adapt it to the purpose for which I wish it. I used A sewing silk, and afterwards waxed apothecary's twine, but without success. I have had better success by using a 2 inch gold beater's skin for a diaphragm and a fine silk thread supported at the angles with loops of thread. A. We do not think the thread telephone will work around more than 4 or 5 angles. The rubber loops should be put under considerable tension.

How can I make impression paper, like the inclosed sample? A. The paper (unsized) is prepared with a warm paste of lard, with a few per cent of beeswax and lampblack.

Can I make any solution of beeswax to flow on glass plates like collodion for etching purposes? I have tried the ethereal solution, but it is too mealy. A. You may dissolve the wax in benzole or absolute alcohol—the glass should be thoroughly dry before flowing. It is best to warm the plate afterwards to cause a semi-fusion and hardening of the coating.

(18) C. J. B. asks: What is the best form for a steamboat drawing not more than 2½ feet of water when loaded, carrying from 50 to 75 persons with comfort—propeller, side wheel, or steam wheel? And which could be run with the greatest speed, say 12 to 15 knots an hour? A. We think a sidewheel boat would be preferable, on some accounts.

(19) W. H. B. asks: What weight (pounds) placed on the middle of a cast iron bar 1 inch by 1 inch (square section), and 3 feet long between supports, would deflect it the 100th of an inch; and what weight the 50th of an inch (casting to be of good No. 1 pig soft machine casting)? What would be the section of the material now known as steel castings (square section) to have equal resistance to deflection as the cast iron above mentioned? A. Trautwine gives the following rule, with approximate constants, remarking that the constants, in important cases, should be determined by experiment. w=weight of bar, in pounds, between supports. W=center load in pounds. D=clear span in feet. B=breadth of bar in inches. d=depth of bar in inches. I=deflection in inches. $I=\frac{(w\times 0\cdot625+W)\times D^3\times \text{constant}}{B\times d^3}$. Constant: Average cast iron—0·000025. Average steel—0·000013. From this formula you can calculate answers to your queries.

(20) A. S. asks: Can a boat be propelled against the wind, using a windmill as the motive power? I claim it can; a friend of mine claiming to the contrary, he says the windmill would turn the screw, but the force of the wind against the windmill would keep the boat stationary, and with friction and the wind against the boat the boat would drift astern. Will you please settle the question in your next issue? A. We think you are right.

(21) G. L. asks for the best method of making paste for use with a pasting and folding machine. A. Four parts, by weight, of glue are allowed to soften in 15 parts of cold water for some hours, and then moderately heated until the solution becomes quite clear; 65 parts of boiling water are now added, with stirring. In another vessel 30 parts of starch paste are stirred up with 20 parts of cold water, so that a thin milky fluid is obtained without lumps. Into this the boiling glue solution is poured, with constant stirring, and the whole is kept at the boiling temperature. After cooling, 10 drops of carbolic acid are added to the paste. This paste is of extraordinary adhesive power, and may be used for leather, cardboard, etc., as well as for paper. The paste in the reservoir should be kept from the air as much as possible to avoid loss of water by evaporation.

(22) C. F. H. asks for the best form of a mild galvanic battery, which can be used daily for the benefit of the health without giving a violent shock. A. See reply No. 24 in No. 9 of current volume of this paper.

(23) C. F. G. writes: My driving pulley on main shaft is 96 inches diameter, and I run my engine at 100 revolutions. My driven pulley on countershaft is 29 inches, and the driving pulley on countershaft is 39 inches, and pulley on saw mandrel is 24 inches, which gives my saw 537 revolutions per minute, and consequently does not give my saw speed enough. Now the trouble is, if I enlarge my driving pulley on countershaft, the saw does not give the same satisfaction as it now stands. I know that the saw ought to have more speed, and I do not know how to proportion my pulleys to get proper speed. How shall I make the necessary changes so as to give my saw 1,000 revolutions per minute, and if I am driving my engine too fast for the length of stroke? The cylinder is 12 inches bore, 3 feet stroke. A. If you have room it might be better to put in an additional countershaft. If this is not convenient, enlarge the pulley on engine shaft. In this case it may be necessary to widen the belt. The speed of the engine is not too great, if it is well built.

(24) A. O. P. writes: In the propulsion of vessels, other things being equal, which has the most pulling power, the screw or the side wheel? A. The screw, as we understand your meaning.

(25) J. H. H. writes: I am using a four side moulding machine at a speed of 4,000 revolutions per minute, to plane blind slats. It feeds at the rate of 1,240 feet per hour, and does its work so that no further finish is required, although many of the slats are for oil finish. I find that one tenth of an ounce difference in weight of the cutting bits will produce the ridges spoken of in your reply to G. B. M. (17) in No. 6 of current volume. Hence I conclude that the cutter heads must be exactly in running balance. It is no uncommon thing to see a planer running with a jar and noise that is deafening, and, in shop parlance, turning out good washboard stuff. The fault is with the operator. Every shop should have a pair of balance scales, and the planer knives should be balanced every time they are ground. The result will be, with a good machine, good smooth work and a reduction in cost of repairs. I say a good machine, that is, any machine with true arbors and a perfectly balanced cylinder head is a good machine, or at least will do smooth work, other things being equal.

(26) C. J. O. writes: The statement that the use of tomatoes as an article of food produces or promotes the development of cancer has created some excitement here. Is there any foundation for such a belief? A. No.

(27) B. H. S. and J. R.—The following methods are recommended for tempering mill picks: 1. Take 2 gallons rain water, 1 oz. of corrosive sublimate, 1 of sal ammoniac, 1 of saltpeter, 1½ pints rock salt. The picks should be heated to a cherry red and cooled in the bath. The salt gives hardness, and the other ingredients toughness to the steel; and they will not break if they are left without drawing the temper. 2. After working the steel carefully, prepare a bath of lead heated to the boiling point, which will be indicated by a slight agitation of the surface. In it place the end of the pick to the depth of 1½ inches until heated to the temperature of the lead, then plunge immediately in clear cold water. The temper will be just right if the bath is at the temperature required. The principal requisites in making mill picks are: First, get good steel. Second, work it at a low heat; most blacksmiths injure steel by over heating. Third, heat for tempering without direct exposure to the fire. The lead bath acts merely as protection against the heat, which is almost always too great to temper well.

(28) J. M. F. asks: What is the cheapest, or rather, which will throw or raise the most water, say 4 feet high, a properly constructed marine pump, or an elevator made of two chains connected together by boards and running in a flat box driven by a 5 or 10 horse power engine? A. We recommend the pump.

(29) G. B. asks: How powerful a telescope is required to see Saturn and his rings, and also one that will bring Jupiter's moons in view? Tell me how large a one it must be, and where one could be purchased, and the probable cost. A. A telescope having a two inch objective would answer, although a three or four inch would be much better. Any of the dealers in optical instruments could supply you. The cost of a good two inch is $55.

(30) S. B. B., A. H. P., N. H. S., G. R., and others.—The diaphragm of a phonograph needs to be clamped tightly in the mouthpiece between two rings of blotting paper. The mouthpiece should be tight or nearly so. The wooden hammer or spring should not spring except at a point near the end attached to the mouthpiece. The spring should not be too delicate, and it must bear with some little force on the diaphragm. The needle should be short and carefully sharpened. A long needle and a weak spring will cause rattling. The paraffin is applied to the plaster of Paris cylinder to permit of turning without chipping it.

(31) J. H. asks for the best and most economical method of making a cellar bottom waterproof against the tide. I have already without the desired ef-

feet laid a course of bricks in cement mortar, with a 4 inch layer of concrete above, composed of Rosendale cement 1 part, gravel and sand 3 parts. A. Make an inverted brick arch of slight curvature, coat it with pitch, lay over it a course of brick, and upon the brick place a layer of from three to six inches of broken stone, and grouted with hydraulic cement and sand and gravel. We think you should use equal parts of sand and cement in making the grout.

(32) J. D. asks whether or not compressed air (say in a wood or iron box) retains the heat which it receives by compression. If so, for what length of time, considering the box to be airtight? A. The air will not retain its heat.

(33) F. A. asks: 1. Would the contact of large bodies of iron or steel, or other conductive material, with a telegraph wire interfere with the transmission of messages, provided the wire is not disconnected at any point? A. No, providing the large body were insulated. 2. Could messages be sent through a cylinder three inches diameter, as well as the ordinary wire now in use? A. We think so. 3. Again, has the idea ever been advanced of sending mail matter by means of a very small railway constructed exclusively for that purpose, and carrying neither engineer nor other passenger? Such an engine and boiler without furnace might be made to traverse a single rail at the rate of say 1½ miles per minute. Automatic arrangements could be applied for stopping. And boilers for replenishing be located at suitable intervals. A. We are not aware that such a railway has been constructed.

(34) W. E. J. asks: Will you please give me a recipe for making the carbons used in batteries, for electric light, etc.? A. See reply to query 24, p. 123, of No. 8 of current volume of SCIENTIFIC AMERICAN.

(35) J. L. G. writes: I want to construct a small, light car to run upon a plank walk. The axle of the driving wheels—which will be about 2½ feet in diameter, that is, the wheels—will have two cranks so constructed that when the lever power is dead on one of the cranks, the other will have all the power applied by the other lever, or to make it more plain, to work on the same principle as the driving wheels of a locomotive. The driving wheels will be attached to the axle in such a manner that they will, when in gear, be propelled by the axle (or only one wheel need be attached to axle in making a turn), and by throwing both wheels out of gear the axle may still continue to be propelled by the engines, but it will have no control over the driving wheels. The car will be about seven feet long, six feet high, two feet wide, and constructed of the lightest material possible, and the total weight, including engineer, will not exceed 275 lbs. Now what I desire most to know is (1) whether two engines, cylinder of 2 inch bore and 4 inch stroke, one boiler, will furnish enough power to propel the car. A. Yes. 2. How many lbs. of steam to the square inch will be required to furnish the two engines with sufficient power to do the work? A. 80 to 90. 3. Do you think the car will work after it is completed? A. Yes, if properly built.

(36) H. W. B. and F.—You will find good descriptions and drawings of beam engines in Weissenborn's and Moore's works on "American Engineering."

(37) B. F. J. and E. C. ask how to make jet black ink that is shiny and glistening when applied. A. Dissolve in ½ pint of soft water ¾ oz. of potassium bichromate, and add the solution to 6 ozs. of logwood extract dissolved in 1 gallon of water; then dissolve in 1 gallon of water, by continued boiling, borax 6 ozs., shellac 1½ oz. Mix all together while warm and add ammonia, 3 ozs.

How can I temper twist drills? A. Heat them to a cherry red, plunge in cool water, and draw down to a yellowish purple.

What solution is best for giving white deposit in nickel plating, and how made? A. See p. 209, vol. 38, SCIENTIFIC AMERICAN.

How are lenses placed in a camera obscura? A. If used with a mirror place the surface of the lens the curvature of which has the shorter radii toward the light. See p. 212, SCIENTIFIC AMERICAN SUPPLEMENT.

(38) J. W. R.—See reply to B. F. J. and E. C., above.

(39) M. W. C. asks how to make Japan varnish for iron. A. A good black japan is made of burnt umber, 4 ozs.; true asphaltum, 2 ozs.; boiled oil, 2 quarts. Dissolve the asphaltum at first in a little oil, using a moderate heat, then add the umber ground in oil, and lastly the rest of the oil, and incorporate thoroughly. Thin with turpentine.

(40) W. L. I. asks: 1. Can I produce a continuous electric current under water, having the circuit broken and complete by the revolution of a wheel under water? A. Yes. 2. If so, how can I insulate copper wire for the purpose, so that it may be wound upon a reel about 6 inches in diameter? A. By covering it with gutta percha. 3. What is the strain of an ordinary log on its line, ship sailing 15 knots? Is the electric current upon the bottom of ship strong enough to run a very small mechanical engine? A. We do not know of any experiments upon these points. 4. Also, how can the area of a screw propeller be found? A. The method, briefly stated, consists in applying one of the rules for determining irregular areas to the development of the blades.

(41) C. K., O. P. R., G. S. F., G. R. W., C. C. S., and others.—Correspondents who sign only initials to their letters should not expect replies. We insist on this rule, as there are inquiries which we prefer to answer by mail.

(42) C. B. asks: 1. Can you give me some information in regard to the process and machinery necessary to make artificial ice? Does it take very expensive apparatus, and where can such be procured? A. Consult articles on this subject on pp. 40, vol. 35, 95, 335, and 168, vol. 37, and 159 and 389, vol. 38, SCIENTIFIC AMERICAN; also pp. 507, 425, 1159, 1348, and 1430, SCIENTIFIC AMERICAN SUPPLEMENT. 2. Could it be made on a comparatively small scale with any degree of success? A. Yes, but not economically.

(43) G. E. B. writes: In SCIENTIFIC AMERICAN, No. 7, vol. 39, you notice an improvement in electro-magnets by M. Ernest Bisson, of Paris. I made a magnet in the same way five years ago and found it stronger than common magnets.

(44) A. M. W. writes: 1. I have a Bell telephone, and wish to put in circuit the Hughes microphone as a resonator. Will you inform me how it can be done? A. The microphone is used as a transmitter. 2. Would I be allowed to construct a phonograph from your drawings in SUPPLEMENT 133, p. 2112, and use for my own amusement without liability to prosecution for infringement? A. See editorial entitled "Rights of Investigators," No. 11 of current volume.

(45) S. V. H.—See reply to 12, in "Notes and Queries" in No. 11 of current volume.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Many of our correspondents make inquiries which cannot properly be answered in these columns. Such inquiries, if signed by initials only, are liable to be cast into the waste basket.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

July 23, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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Flour, C. B. Anders & Brother	6,384
Flour of mustard, J. H. Brand & Co.	6,397
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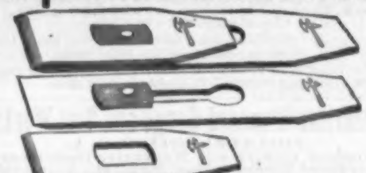

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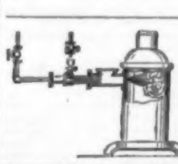

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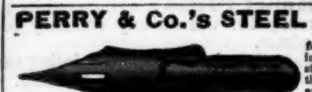

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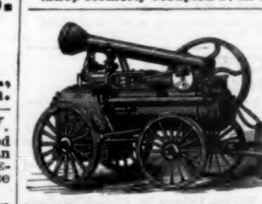

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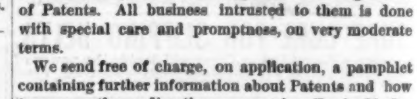

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